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Shell Oil Company

One Shell Plaza
P.O. Box 2463
Houston, Texas 77252

AR2603

December 6, 1991

via Federal Express

Thomas C. Dunkelman
(H-7-1) U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

Re: Del Amo Facility Site, Los Angeles, CA
Shell Oil Company's First Supplemental Response to
EPA's 104(e) Information Request

Dear Mr. Dunkelman:

Enclosed are additional documents considered responsive to the above-captioned Information Request dated August 23, 1991 and received by Shell on August 29, 1991. Shell's initial response to this Information Request is dated October 2, 1991. Although the EPA has not directed specific questions to Shell in the Information Request, it is Shell's understanding-as noted in our initial response-that the EPA, in part, is seeking information related to the generation, storage and use of hazardous substances in connection with the operation of the Torrance Chemical Plant formerly owned by the United States Government and Shell Chemical Company. The following documents are submitted as responsive to the previously identified category "Information Regarding the Torrance Chemical Plant." (Shell incorporates by reference herein the General Statement and general objections to the Information Request noted in Shell's initial response).

- Preliminary Site Investigation prepared by Ken O'Brien and Associates for Cabot, Cabot and Forbes dated September 22, 1973 (three volumes). (Attachment 1).

- Preliminary Soils Investigation prepared by Sladden Engineering for Cabot, Cabot and Forbes dated September 18, 1979. (Attachment 2).

- General Correspondence between Cabot, Cabot and Forbes and the California Department of Health (July-August, 1983). (Attachment 3).

- Preliminary Subsurface Investigation prepared by Levine-Fricke for Harbor Technology Center located at 20280, 20300 Vermont Street dated December 21, 1990 and recently submitted to Shell. (Attachment 4).

The documentation noted above in the first three attachments is in the possession of the CAL-EPA, Department of Toxic Substances Control (formerly the California Department of Health Services) and therefore presumably has also been available to the EPA. Nevertheless, in the interest of full disclosure to the EPA, copies of these documents are being provided herein. It should also be noted that none of the documentation provided herein was produced by or generated at the request of Shell Oil Company and therefore no assurances are given as to the accuracy, completeness, or quality of the data contained therein, and in that respect, these documents are similar to the environmental investigative reports prepared by the Hamilton Dutch Investors and made available to the EPA for review at the law offices of Schreiber and Horn as noted in Shell's initial response to the Information Request.

In addition, Shell is continuing the review of the voluminous material recently identified in archive storage which may contain information potentially responsive to the EPA's Information Request. Shell has recently indexed and prioritized this material and will provide EPA with any responsive documents in a timely fashion.

Please contact me at (713) 241-5633 if you wish to discuss this matter further.

Very truly yours,

Thomas W. Kearns
Attorney

TWK:ct

Enclosure

cc: W/O Attachments
Jeannie Cervera
Office of Regional Counsel,
RC-3222
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

[redacted]

0639-2335

Attachment 1

Powell, G.P.

O'Brien Study

PRELIMINARY SITE INVESTIGATION
PROPOSED INDUSTRIAL PARK DEVELOPMENT
SHELL CHEMICAL PLANT PROPERTY
LOS ANGELES, CALIFORNIA

for

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO.,INC.
September 22, 1972

Vol. I of III

PRELIMINARY SITE INVESTIGATION
PROPOSED INDUSTRIAL PARK DEVELOPMENT
SHELL CHEMICAL PLANT PROPERTY
LOS ANGELES, CALIFORNIA
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C.C.&F. WESTERN DEVELOPMENT CO.,INC.
September 22, 1972

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LOS ANGELES, CALIFORNIA
for
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO.,INC.
September 22, 1972

I INTRODUCTION

A. Purpose

The purpose of this report is to present the findings of a preliminary study of the surface and subsurface conditions of the Shell Chemical Plant property located in the southern part of Los Angeles, California.

B. Location

The Shell Chemical Plant property (approximately 277 acres) is located a short distance to the southwest of the intersection of the San Diego and Harbor Freeways. Refer to Plate No's. 1 and 2. The property is separated into two parts. One portion (approximately 195 acres) is bordered on the north by 190th Street, on the east by Vermont Avenue, on the south by the extension of Del Amo Boulevard, and on the west by an industrial area whose frontage is on Normandie Avenue. The second portion (approximately 82 acres) is bordered on the north by Knox Street, on the east by Hamilton Street, on the south by Del Amo Boulevard, and on the west by Vermont Avenue.

C. Authorization

This preliminary site investigation was authorized by Cabot, Cabot & Forbes, C.C.&F. Western Development Co.,Inc., Los Angeles, California. The objective of this investigation is to determine the suitability of the Shell Chemical Plant property for development into an industrial park.

D. Scope

This report presents subsurface information including geology, seismology, soils, results of laboratory tests on typical subsurface materials, location of sumps and contaminated areas, description of existing structure foundations, and description of existing utilities (sewers, storm drains, water mains, gas mains, etc.). This report also presents information on surface conditions such as existing streets, railroads, buildings, drainage, utilities, etc.

The findings of the preliminary site investigation are presented to indicate the nature of the problems that will be encountered in developing the Shell Chemical Plant property into an industrial park. The report recommends which existing facilities and utilities should be retained. A series of industrial park layouts were developed and the most promising preliminary plan at this time is included. Refer to Plate No. 3.*

*In Folio

II ENGINEERING GEOLOGY

A. Geology and Physiography

The Shell Chemical Plant site is located physiographically in the Angeles Section of the Pacific Border Province. This particular area is known as the Torrance Plain and is of marine origin.

It is understood that the site prior to construction of the Chemical Plant in 1941 was used for agricultural purposes.

Geologically, the site is underlain by Pliocene and older rocks. Refer to Plate No. 4. These are overlain by the San Pedro formation and unnamed Upper Pleistocene deposits. Above these, occur the Palos Verdes Sand or equivalent of Upper Pleistocene age. The highly fossiliferous sand encountered in Auger Boring No's. 5, 8 and 15 drilled during the subsurface investigation, and the thin coquina beds encountered in Boring No's. 5 and 15 probably represent the basal portion of the Palos Verdes sand zone. The reddish brown deposits encountered in Auger Boring No's. 8, 12, 15, 17, 19, 21 and 22 represent terrace cover of probable flood plain origin or may be the upper few feet of the Palos Verdes sand modified by weathering. The dark brown to black organic near surface material probably represents remains from the original agricultural usage.

B. Faulting

The southernmost trace (exact location uncertain) of the Avalon-Compton fault is located approximately 3 miles northeast of the area of interest on the north flank of Dominguez Hill and trends in a northwest direction.

A short, inferred fault is mapped 3-1/2 miles southeast of the site, trending northwest towards the area of interest. There is no reported evidence of movement along either of these faults during Recent time (±18,000 years). The northwest-southeast trending Palos Verdes fault zone is located approximately 5 miles to the southwest of the site. This fault is considered active.

The thin marker beds (shell and Coquina) encountered in Boring No's. 5, 8 and 15 indicate that there has been no displacement at the site due to faulting. No faults are mapped or were observed in the immediate vicinity of the Shell Chemical Plant property.

C. Seismology

A study of epicenter events[1] for the general area (recorded since 1934) reveals that the largest earthquake event in the general area occurred in 1941 and had a magnitude ≥ 5 (Richter scale) but less than 6 (the damaging Long Beach earthquake of 1933 had a magnitude of 6.3). The epicenter for

[1]An epicenter map is not included in this report because the latest data available is being compiled for publication by the California Institute of Technology. The information has not been published and is proprietory until that time.

this earthquake appeared to be located in the Palos Verdes fault zone, approximately 5 miles south of the site. Numerous earthquake events of a magnitude of 4 or less have been recorded along this fault zone and in the near vicinity. The latest available information is for 1970 and is considered preliminary. This shows that approximately 17 events of magnitudes of 4 or less occurred along the Palos Verdes fault zone and in the general area of interest (a circle with a 5-mile radius centering on the site) during 1970. The average number of earthquake events over the past 37 years is approximately five per year. With the exception of 1941, all of these events had a magnitude of 4 or less. Most of the events were probably so low in magnitude that they were not noticed by the general public and could only be detected by instrumentation.

It is not possible to predict earthquakes at this point in time. However, the general area (5-mile-radius circle) is seismically active, primarily to the southwest. It is likely that a structure in this area will be subject to the effects of several shocks per year with a magnitude of 4 or less, the majority of which will probably not even be noticed. Some time during the lifetime of structures on this property, they will probably be subjected to the effects of a shock of the magnitude of 5 or 6. A microregionalization map of the Los Angeles Basin shows that a shock with a probable maximum intensity of VIII (Modified Mercalli scale) is possible within a 100-year period in the general area of the proposed site.

As there is no evidence of faulting in the immediate vicinity of the site, the probability of surface rupture due to earthquake activity is remote.

Ground shaking intensity depends on the distance from the earthquake source (epicenter, fault), i.e. the greater the distance, the less the intensity but the longer the duration; however, soil conditions can influence the intensity.

Soil conditions at this site are generally favorable in that the material encountered consists of a relatively homogeneous and dense lithologic sequence. A general classification of the materials encountered are: sandy clay, clayey sand, sand, and silty/clayey sand. The relative blow count, by a standard penetration test (i.e. driving a 1-1/2-inch I.D. split spoon sampler with a 140-pound hammer falling 30 inches) ranges from 8 to 39 blows per foot of penetration.

Two of the 38 borings drilled at the site were to depths of 50 feet and one was drilled to 60 feet. Two of the three deep borings encountered an extremely well cemented shell formation (Coquina) at 45 and 49 feet (Boring No's. 5 and 15). Refer to Plate No's. 35 and 45.

D. Subsidence

In several areas of the Los Angeles basin, ground subsidence has been occurring due to pressure relief from the withdrawal of fluids from deep oil, gas, and water zones.

Mr. L. R. Donkle, Staff Engineer, Shell Chemical Company, who has been assigned to the plant for 29 years, reports that no subsidence has been noted in the plant area during his tenure.

E. Partial Reference - Engineering Geology

Albee, Arden L. and Smith, J. L.; Earthquake Characteristics and Fault Activity in Southern California, 1966.

Barosh, J. P.; Use of Seismic Intensity Data to Predict the Effects of Earthquakes and Underground Nuclear Explosions in Various Geologic Settings, USGS Bulletin 1279, 1969.

California Department of Water Resources; Crustal Strain and Fault Movement Investigation, Bulletin 116-2, 1964.

California Division of Mines and Geology; Earthquake Intensities, 1972.

California Division of Mines and Geology; Faults and Earthquakes.

California Division of Mines and Geology; Provisional Fault Map of California, 1972.

Hileman, J.; Southern California Network Epicenter Maps (unpublished), California Institute of Technology, 1972.

Poland, J. F., Garrett, A. A. and Simnott, A.; Geology, Hydrology, and Chemical Character of Ground Waters in the Torrance-Santa Monica Area, California, USGS Water Supply Paper 1461, 1959.

Wiegel, Robert L., et al.; Earthquake Engineering, 1970.

III SOIL INVESTIGATION

A. Field Investigation

The subsurface field investigation consisted of drilling auger borings and excavating backhoe trenches within the Shell Chemical Plant property at the locations shown on Plate No. 5.* Western Laboratories arranged for the bucket auger drilling and backhoe trench excavations. Twenty-two auger borings were drilled with an 18-inch bucket auger. Nineteen borings were drilled to a depth of 25 feet, two to a depth of 50 feet, and one to a depth of 60 feet. ~~Contaminated Area Nos. 1 and 2 discovered by Boring No. 2 were investigated for~~ areal extent and depth ~~by drilling sixteen 24-inch bucket auger~~ borings and excavating 34 backhoe ~~trenches. The oil and chemical~~ Contaminated Area No. 3 discovered by visual reconnaissance was investigated for areal extent and depth by excavation of three backhoe trenches (No's. 23, 26 and 27). Two other backhoe trenches (No's. 24 and 25) were excavated to examine other potential contaminated areas. Refer to Plate No. 5* for the location of the auger borings, backhoe trenches and contaminated areas.

Engineering geologists (one each from Western Laboratories and Ken O'Brien & Associates) supervised the drilling of the auger borings and backhoe trenches, classified the subsurface materials, and prepared a field log for each boring and backhoe trench. The auger boring and backhoe trench logs are included, Plate No's. 31 through 74.

*In Folio

Soil samples were recovered from the auger borings utilizing a 2.43-inch I.D. split spoon sampler that contained either 1-inch rings and/or 5- or 6-inch sleeves. Standard penetration tests were made with a 1-1/2-inch I.D. split spoon sampler driven by a 140-pound hammer falling 30 inches. Disturbed samples were also recovered at various intervals for moisture content determination and grading analysis.

B. Laboratory Testing

Representative samples of subsurface materials recovered from the soil borings were subjected to the following laboratory tests that were performed by Western Laboratories.

In situ Moisture Content
In situ Density
Gradation/Hydrometer
Atterberg Limits
Unconfined Compression
Consolidation and Swell
Swell Tests
Direct Shear

The in situ moisture content and density determinations are recorded on the boring logs. The results of the remainder of the tests are presented on Plate No's. 9 through 30.

C. Subsurface Conditions

The materials encountered in the soil borings consisted of a heterogeneous mixture of sandy clay, clayey sand, silty sand, sand, sandy silt and silty clay. This heterogeneous mixture extends to approximately ±40 feet in depth. In Boring No's. 5, 8 and 15, a thin sand section containing numerous shell fragments

was encountered at 42, 39 and 44 feet, respectively. A well cemented shell bed (Coquina) was encountered at 45 and 49 feet in Boring No's. 5 and 15, respectively. The typical subsurface soil conditions for the Shell Chemical Plant property, except for the contaminated areas, are presented on Plate No. 6.

As previously mentioned, three contaminated areas were found during the subsurface investigation. The areal extent of the contaminated areas is shown on Plate No. 7. A profile of the vertical extent of contamination in Area No's. 1 and 2 are shown on Plate No. 8. The contamination consists of oil-saturated native materials in Area No's. 1 and 2. In Area No. 3, the oil saturation extends to 5-foot depth and below this depth the native materials have been chemically contaminated to approximately 10 feet. The contamination in Area No. 2 also includes debris (broken concrete, wood, old tires, etc.) that was dumped into the sumps.

D. Properties of the Subsurface Materials

The properties of the subsurface materials encountered at the Shell Chemical Plant property based on laboratory tests are summarized in the following tabulation:

Property	Range	Average
In situ Moisture Content - % dry weight	5 to 37	16
In situ Dry Density - lbs/ft^3	79 to 134	112
Liquid Limit (sandy clay @ 3.5 to 4.5 foot depth)	32 to 43	37
Plasticity Index (sand clay @ 3.5 to 4.5 foot depth)	10 to 23	18
Unconfined Compressive Strength (kips/ft^2)	3.1 to 12.4	7.3
Standard Penetration - blow/ft	8 to 39	20
Expansion - percent	0.23 to 0.95	0.55
Direct Shear Test Results		
Cohesion - lbs/ft^2	800 to 1,450	1,195
Angle of friction (Ø) - degrees	24 to 32	27

IV SITE EVALUATION AND ANALYSIS

A. Site Description

The Shell Chemical Plant property (approximately 277 acres) as previously described is separated into two parts by Vermont Avenue. The portion west of Vermont Avenue (approximately 195 acres) is bordered on the north by 190th Street, on the south by the dedicated right-of-way for Del Amo Boulevard, and on the west by a Los Angeles County industrial area whose frontage is on Normandie Avenue. The portion east of Vermont Avenue (approximately 82 acres) is bordered on the north by Knox Street, on the east by Hamilton Street, and on the south by the dedicated right-of-way for Del Amo Boulevard.

The property is very flat; the total relief is 25 feet sloping to the east (approximately 0.7 percent slope). The elevation of the site is 20 to 45 feet above mean sea level.

The Shell Chemical Plant occupies the property consisting of an Elastomer Technical Center; and Butadiene, Styrene and Polymer Units. The existing structures and facilities consist of office buildings, warehouses, shops, compressor stations, pump stations, tanks, stacks, towers, exchangers, vessels, columns, coolers, substations, etc. The existing plant is supported by an extensive system of underground utilities consisting of water distribution systems (domestic, utility and fire), sewer collection system (sanitary and process), storm drains, steam and gas distribution systems.

B. Foundation Conditions

The soil investigation revealed that the subsurface materials are competent except for three contaminated areas. The subsurface materials consist of a heterogeneous mixture of sandy clay, clayey sand, silty sand, sandy silt and silty clay to a depth of approximately 40 feet. Below that depth, the subsurface materials consist of sand and shell fragments including a well cemented shell bed (Coquina) to approximately 57 feet.

Because of the competent nature of the subsurface materials, spread footing foundations can be utilized to support structures that may be constructed at this proposed industrial park site. Based on strength data determined by laboratory tests, the following are allowable soil bearing values for the near subsurface materials:

Continuous Footings	-	4,000 pounds per square foot
Square Footings	-	5,000 pounds per square foot

The depth of embedment of footings must be equal to or greater than the width of the footing. The above bearing values are for maximum embedment of 5 feet and includes normal live load plus dead load and the weight of the footing.

Settlement analyses were made in order to obtain an order of magnitude of settlement under foundation loads. For a 5-foot square footing embedded 5 feet with a load of 5,000 pounds per square foot, the settlement will range from 2 to

5 inches. The maximum settlement assumes the subsurface soil conditions reflect the weakest material encountered. The 2-inch settlement assumes the subsurface conditions reflect the strongest material encountered. For smaller size footings, the settlement will be considerably less. The 5-inch settlement is a theoretical value that would never actually be attained because allowable load would never be imposed on the foundation soils 100 percent of the time.

Pilings or caissons would only be required to support extremely heavy structures. For the normal light to medium type industrial structures, spread footings can be utilized without problem.

Each foundation design for industrial structures must be individually analyzed. The foregoing bearing values and estimated amount of settlement are given for informational purposes only and should not be used carte blanche.

C. Contaminated Areas

Three contaminated areas were disclosed during the subsurface investigation. As previously mentioned, the areal extent of the contaminated areas is shown on Plate No. 7 and the profile of the vertical extent of Contaminated Area No's. 1 and 2 is given on Plate No. 8.

In Area No's. 1 and 2, the contamination consists of oil-saturated materials that are soft and unstable. In addition, Area No. 2 contains debris consisting of concrete rubble, organic material, steel, clay pipe, etc. The depth of contamination

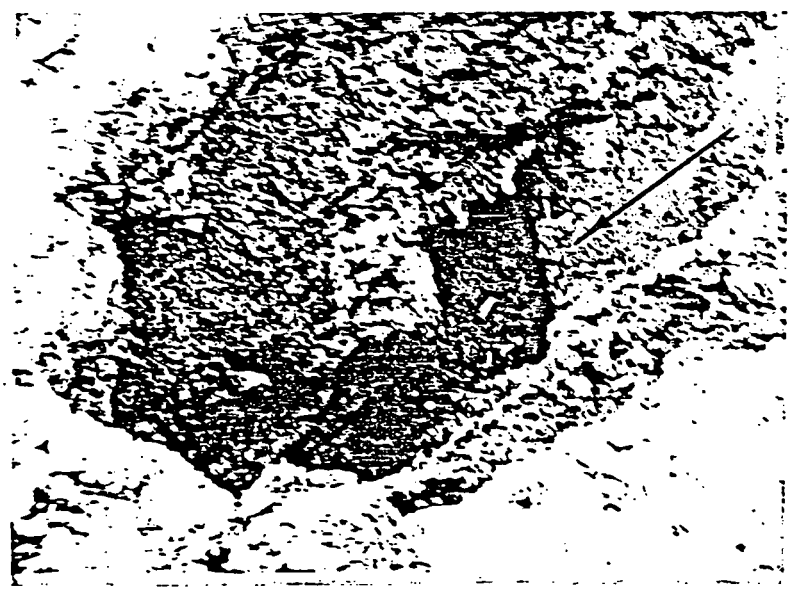
in Area No. 1 is 5 feet and in Area No. 2, is 25 feet. In Area No. 3, the oil saturation extends to 5-foot depth and below this depth, the native materials have been chemically contaminated to approximately 10 feet.

Area No. 1 is approximately 670 feet long and 110 feet wide (1.7 acres); Area No. 2 is approximately 390 feet long and varies in width from 60 to 150 feet (0.6 acre); and Area No. 3 is approximately 250 feet long and averages 170 feet wide (1.0 acre). The contaminated areas are not suitable as building sites and in their present condition could be used only for parking areas or storage sites. It is feasible to remove and replace the materials in Area No. 1; the feasibility of removing and replacing materials in Area No. 2 is marginal; and it is not feasible to remove and replace the materials in Area No. 3.

The amount of contaminated material in Area No. 1 is approximately 15,000 cubic yards. The cost to remove this material is estimated at $2.50/cubic yard plus the charge to haul the material to a disposal site. Area No. 2 contains approximately 24,000 cubic yards of contaminated material. The cost to excavate this material will probably amount to $5.00/cubic yard plus the cost of hauling to a disposal site. Area No. 3 contains approximately 16,000 cubic yards of contaminated material. The cost of excavating this material will be approximately $4.00/cubic yard plus the cost of transporting the material to a disposal site.

Photograph No's. 1 and 2 (following page) shows the oil-contaminated material and the debris found in Contaminated Area No. 2.

PHOTOGRAPH NO. 1
Oil-Contaminated Material



PHOTOGRAPH NO. 2
Concrete Slab (arrow) and
Miscellaneous Debris

D. Demolition

The Shell Chemical Plant property site contains a great number of structures that are aboveground and the site also includes many underground utilities. The aboveground structures and underground utilities were designed to support a petrochemical operation. Almost all of the buildings and utilities cannot be utilized to support a modern industrial park. Those few permanent buildings that could possibly be usable will require a great deal of renovation and it is most probable that the existing location of these facilities would compromise the planning of an efficient industrial park layout. The existing in-plant road and streets are substandard and do not comply with the requirements of the City of Los Angeles. The railroad tracks within the in-plant area are for the most part improperly located to support a modern industrial park.

All aboveground surface structures should be removed. All near surface foundations (depths of 2 to 3 feet or less) should also be removed. Those foundations which are at a depth greater than 3 feet can remain in place and should be identified so that future industrial park pla-ning and industrial building construction can take into account whether or not they will have to be removed.

All existing underground utility lines that cross or are within the right-of-way of future dedicated streets will have to be removed. All other utility lines can remain in place but

should be purged. These utility lines may have to be removed when industrial building construction and development of individual lots occurs.

A majority of the in-plant railroad track will have to be removed and reconstructed to support the industrial park layout. The railroad track and ties are salvagable. The ballast is not salvagable but can be utilized in the construction of structural sections for streets and parking areas.

The cost of removing railroad track is approximately $2.00/linear foot. The cost of reconstructing railroad track (utilizing used track and ties with new ballast) is approximately $10.00/linear foot.

E. Grading

The Shell Chemical Plant property is relatively flat. The total relief is 25 feet; the terrain sloping due east from elevation 45 feet at the west property line to elevation 20 feet at Hamilton Street (approximately 0.7 percent slope). Within the plant site, there are areas that have been raised 3 to 4 feet above the existing grade to provide pads for petrochemical structures.

There should be no problem in rough grading the plant site area to the plan of the future industrial park except for existing utilities and foundations that may be encountered. The surface and subsurface materials can be excavated with conventional

earthmoving equipment. It is not anticipated that a great deal of grading will be required to prepare the site for industrial subdivision development.

F. Streets

The existing road and street system of the Shell Chemical Plant cannot be retained and utilized in the proposed industrial park layout. Further, the in-plant road and streets are substandard and do not comply with the City of Los Angeles Bureau of Engineering requirements.

The Preliminary Industrial Park Layout (Plate No. 3) indicates a tentative layout of streets for the proposed industrial park. The Bureau of Engineering has indicated that the total right-of-way width of 64 feet will have to be provided and dedicated. These collector streets will have a paved width of 44 feet with curbs and gutters and a 10-foot parkway on each side within which will be constructed a 5-foot sidewalk.

The Preliminary Industrial Park Layout plan indicates the extension of Knox Street from the west property line to Vermont Avenue and widening of Knox Street from Vermont Avenue to Hamilton Street. The preliminary plan also indicates the extension of Francisco Street from the west property line easterly to Hamilton Street. Whereas Knox Street can be continuous from Normandie Avenue to Hamilton Street, there are problems in continuing Francisco Street. At the present time, Francisco Street is located within Los Angeles County and there is a

cul-de-sac at the east end. Unfortunately, an industrial building projects approximately 2 feet northerly of the south curb line of Francisco Street at the east end, and in order to connect Francisco Street, a slight curvature at this location would be required. This may or may not be possible.

~~The Bureau of Engineering has indicated the following requirements with regard to exterior streets:~~

~~An additional 25-foot right-of-way will be required~~ for the proposed Del Amo Boulevard ~~that adjoins the south boundary of the Shell Chemical Plant property and that construction of one-half of a major highway will be required. One-half~~ of the ~~major highway includes a 40-foot paved width, curb and gutter, and a 10-foot parkway that is fully paved with concrete.~~ This requirement by the Bureau of Engineering will require that the property fence be moved northerly 25 feet and that the railroad ~~tracks paralleling Del Amo Boulevard will have to be removed and relocated.~~

Vermont Avenue is a major highway and at the present time, the right-of-way width is 80 feet. The Bureau of Engineering has indicated that a 100-foot width of right-of-way will be required. This means that an additional dedication of 10 feet on each side of Vermont Avenue will be required from Del Amo Boulevard northerly to Knox Street and 10 feet only on the west side of Vermont Street from Knox Street to 190th Street.

The fence line on the east side of Vermont Avenue between Del Amo Boulevard and Knox Street is on the line of the future right-of-way. There is a fence on the west side of Vermont Avenue from Del Amo Boulevard to Knox Street but it is located westerly of the future right-of-way line. At the present time, the portland cement concrete pavement width of Vermont Avenue on the east side of the centerline from Del Amo Boulevard to Knox Street is 15 feet with a 5-foot asphalt concrete shoulder. The pavement width on the west side is 25 feet with a 5-foot shoulder. North of Knox Street to 190th Street, the pavement width of Vermont Avenue on the west side of the centerline is 25 feet with a 13-foot-wide asphalt concrete shoulder. The fence line on the west side of Vermont Avenue from Knox Street to 190th Street is located along the future right-of-way line.

The Bureau of Engineering has indicated that 190th Street will be constructed to a major highway with a 100-foot right-of-way width. Between the north property line of the Shell Chemical Plant and the new south right-of-way line for 190th Street is a strip of land 50 feet wide which is owned by the City of Los Angeles and contains an open drainage ditch. The Bureau of Engineering has indicated that the City of Los Angeles contemplates the widening of 190th Street at an early date and included therein will be a storm drain constructed by the Los Angeles County Flood Control District. The existing drainage ditch will then be covered and the land sold to the

adjoining property owner. This strip which is 50 feet wide, as previously mentioned, is approximately 1,900 feet long and contains 2.2 acres.

G. Storm Drainage

The development of an industrial park on the Shell Chemical Plant property will require the design and construction of a new storm drainage system. The existing storm drainage system cannot be retained to serve the needs of the proposed industrial development and further will not conform to the requirements of the City of Los Angeles and Los Angeles County Flood Control District.

Fortunately, there are four possible storm drainage outlets for the Shell Chemical Plant property. They are:

(1) The storm drain in 190th Street which drains to the east.

(2) The storm drain in Knox Street that drains easterly of Hamilton Avenue to the Harbor Freeway outlet.

(3) A storm drain located in Kenwood Avenue (a north-south street) located one block south of Del Amo Boulevard, approximately in line with the west boundary of the property.

(4) A Los Angeles County Flood Control channel that is located approximately 900 feet south of Del Amo Boulevard. Access to the Los Angeles County Flood Control channel can be attained via Hamilton Street or Vermont Avenue.

The capacity of the 190th Street drain, the Knox Street drain, and the Kenwood Avenue drain are limited. The Los Angeles County Flood Control District channel has virtually unlimited capacity. The Bureau of Engineering, City of Los Angeles, recommends that in development of the storm drainage system for the proposed industrial development that the subdivision be divided into four drainage zones. These four zones would drain into the aforementioned existing storm drainage systems.

H. Water

Water for the proposed industrial development on the Shell Chemical Plant property will have to be obtained from the Los Angeles Department of Water and Power (DWP). DWP was contacted to ascertain the requirements they would impose for supplying water to the proposed industrial development.

At the present time, there is an existing DWP water main serving the Shell Chemical Plant. The main is located in the proposed right-of-way to be dedicated for Knox Street. A 24-inch main extends from Normandie Avenue to Vermont Avenue; easterly of Vermont Avenue, the main is reduced in size to 20 inches and extends to the Metropolitan Water District line. DWP indicates that this main has served its useful life (31 years) and would be of no value in serving the proposed industrial development. DWP indicates that a complete new system would have to be developed for the industrial subdivision. The water supply is available at 190th Street and Normandie Avenue.

Off-site improvements would probably have to be extended easterly in 190th Street to Vermont Avenue and southerly in Normandie Avenue to Del Amo Boulevard, in Knox Street from Normandie Avenue to the west property line and in Francisco Street from Normandie Avenue to the west property line. On-site improvements would be required along Vermont Avenue from 190th Street to Del Amo Boulevard, along Avenue A, along Avenue B, along Knox Street from the west boundary to Hamilton Street, along Francisco Street from the west property line to Hamilton Street, within the Del Amo Boulevard right-of-way from Normandie Avenue to Hamilton Street, and along the east side of Hamilton Street from Del Amo Boulevard to Knox Street. Refer to Plate No. 3.

Off-site improvements are those which are constructed within a street right-of-way that requires excavation of pavement and replacement thereof. On-site improvements are those which can be constructed prior to paving within the industrial subdivision, and within existing street rights-of-way outside of the pavement area. The water main that would be extended along Vermont Avenue, Del Amo Boulevard, and Hamilton Street would be considered as on-site improvements because they can be constructed within the street rights-of-way without disturbing the pavement.

Preliminary estimates indicate that 12-inch water mains will be required. The cost per foot of off-site improvements is approximately $31.50/linear foot. The cost for on-site improvements would be approximately $13.00/linear foot. Fire hydrants will be required within the industrial development and at the present time, the cost of installing 4 by 4 hydrants is $784.00 each. However, in the near future, the cost of furnishing and installing fire hydrants will be increased 15 percent.

Along the collector streets, fire hydrants can be installed on one side of the street only and spaced 300 to 400 feet apart. Fire hydrants along major highways will have to be placed on both sides of the street at 300- to 400-foot intervals.

DPW indicates that the total cost of the water system (on- and off-site) will have to be borne by the subdivider and this includes cost of the fire hydrants. The water system can be constructed incrementally; however, the terms of payment are cash in advance.

I. Sewers

The existing sanitary sewer system for the Shell Chemical Plant cannot be adapted to support the proposed industrial development. Therefore, local sewer mains will have to be constructed in the collector streets and extended to trunk lines. There is an existing trunk sewer line in Vermont Street that extends from just north of Knox Street, southerly to Del Amo Boulevard, and then easterly in the Del Amo Boulevard

right-of-way to Hamilton Street. There is also a trunk sewer in Normandie Avenue that flows southerly.

The Bureau of Engineering, City of Los Angeles, has indicated that they will designate to which trunk line the sewage collection system for the proposed industrial development will drain. There is adequate capacity in Vermont Avenue and Normandie Avenue to accommodate the sanitary sewage that will be generated in the proposed industrial development.

J. Electricity

The demolition of the Shell Chemical Plant will necessarily include removal of the electrical distribution system. Therefore, an entire new system will be required for the proposed industrial development. The electrical power for the industrial development will be supplied by the Los Angeles Department of Water and Power. There is apparently sufficient power capacity available nearby to support the proposed industrial development. The Preliminary Industrial Park Layout (Plate No. 3) indicates an area reserved for a DPW substation located northerly of the Del Amo Boulevard right-of-way adjoining Normandie Avenue. The electrical distribution system would emanate from this location and extend northerly and easterly.

V SUMMARY AND RECOMMENDATIONS

The following summarizes the pertinent features for the industrial subdivision development of the Shell Chemical Plant property.

A. Site Description

The Shell Chemical Plant is located in the City of Los Angeles, Los Angeles County, California, southwest of the intersection of the San Diego and Harbor Freeways.

The accessibility to the site is good and there are nearby off-ramps from San Diego and Harbor Freeways. Major highways abut the property on the north (190th Street) and on the east (Hamilton Street). Vermont Avenue, a north-south major highway, divides the property into two parts.

The area of the property is approximately 277 acres.

The site is relatively flat, sloping to the east at 0.7 percent grade from elevation 45 feet at the west property line to 20 feet above mean sea level at Hamilton Street.

The subsurface materials are competent; no unusual foundation problems should be encountered except in the three areas that had been used as disposal for oil and chemical materials.

B. Existing Facilities

The existing facilities at the Shell Chemical Plant consist of office buildings, warehouses, vessels, tanks, columns, coalers, exchangers, pump stations, compressor stations, etc. These facilities will have to be removed prior to industrial development since they were designed to support a petrochemical operation and cannot be effectively integrated into a modern and industrial park.

Underground utilities at the Shell Chemical Plant consist of water distribution, sewage collection, storm drainage, and gas distribution. These utilities will virtually have no retention value for industrial development since they too cannot be effectively integrated into a modern industrial park.

C. Analysis of the Features of Industrial Subdivision Development

(1) Grading - No serious grading problems. Materials can be excavated with conventional earthmoving equipment.

(2) Storm Drainage - Four outlets are available for storm drainage and a carefully engineered design can be achieved with relative ease.

(3) Streets - City of Los Angeles, Bureau of Engineering specified that collector streets should be constructed for the interior access to the industrial park lots. These collector streets can be connected to major highways to the north

(190th Street), east (Hamilton Street), west (Normandie Avenue) and within the development (Vermont Avenue)

(4) Water - Los Angeles Department of Water and Power indicates that an adequate water supply is available for proposed industrial development at 190th Street and Normandie Avenue.

(5) Sewage - Sewage collection facilities can be developed to flow into existing trunk lines located in Del Amo Boulevard and Vermont Avenue.

(6) Electricity - Electric power available from Los Angeles Department of Water and Power within the project boundaries.

D. Recommendations

The development of the Shell Chemical Plant property into an industrial subdivision appears to have only two serious problems. The first problem is the demolition of the existing facilities. The demolition of the aboveground facilities should be accomplished without too much problem. Removal of the underground utilities and facilities (foundations) could be costly and it is recommended that only those underground utilities and facilities be removed that are necessary for the development of the proposed industrial subdivision.

~~The street requirements imposed by the City of Los~~ Angeles Bureau of Engineering for the proposed industrial ~~subdivision development are not unusual except for one element.~~

This element is with regard to the dedication of 25 feet of additional right-of-way along the south property line for Del Amo Boulevard and the construction of one-half of the major highway. To meet this requirement would necessitate relocation of the railroad tracks paralleling Del Amo Boulevard.

The property south of the Los Angeles Department of Water and POwer right-of-way and north of Del Amo Boulevard west of Vermont Avenue is of limited value in its present condition because of the two contaminated areas (total area, 2.3 acres). One of the contaminated areas could be removed; however, the cost of rehabilitating the other contaminated area would be prohibitive. It appears that the area to the south of the Department of Water and Power right-of-way probably has a use for parking or storage only.

The potential commercial or industrial development along Del Amo Boulevard from Normandie Avenue to Hamilton Street is limited to the north of Del Amo Boulevard since the area to the south is residential.

The connection of Del Amo Boulevard to the extension of 203rd Street will require a right angle turn to the north at Normandie Avenue and a left turn 186 feet north onto 203rd Street. Therefore, the creation of an efficient east-west major highway utilizing Del Amo Boulevard and 203rd Street will be difficult.

It is recommended that the matter of widening Del Amo Boulevard be pursued as follows. Del Amo Boulevard should be

designated as a collector street and not as a major highway. This would reduce the right-of-way requirement for Del Amo Boulevard from 100 to 64 feet and only 7 feet of additional right-of-way would be required. Dedicating only 7 feet of right-of-way along the south property line would allow the northerly track of the parallel tracks along Del Amo Boulevard to remain in place. The southerly track would have to be removed and the northerly track extended to cross Vermont Avenue, approximately 15 feet north of the existing crossing.

CABOT, CABOT & FORBES

C.C.&F. WESTERN DEVELOPMENT CO., INC.

REGIONAL MAP

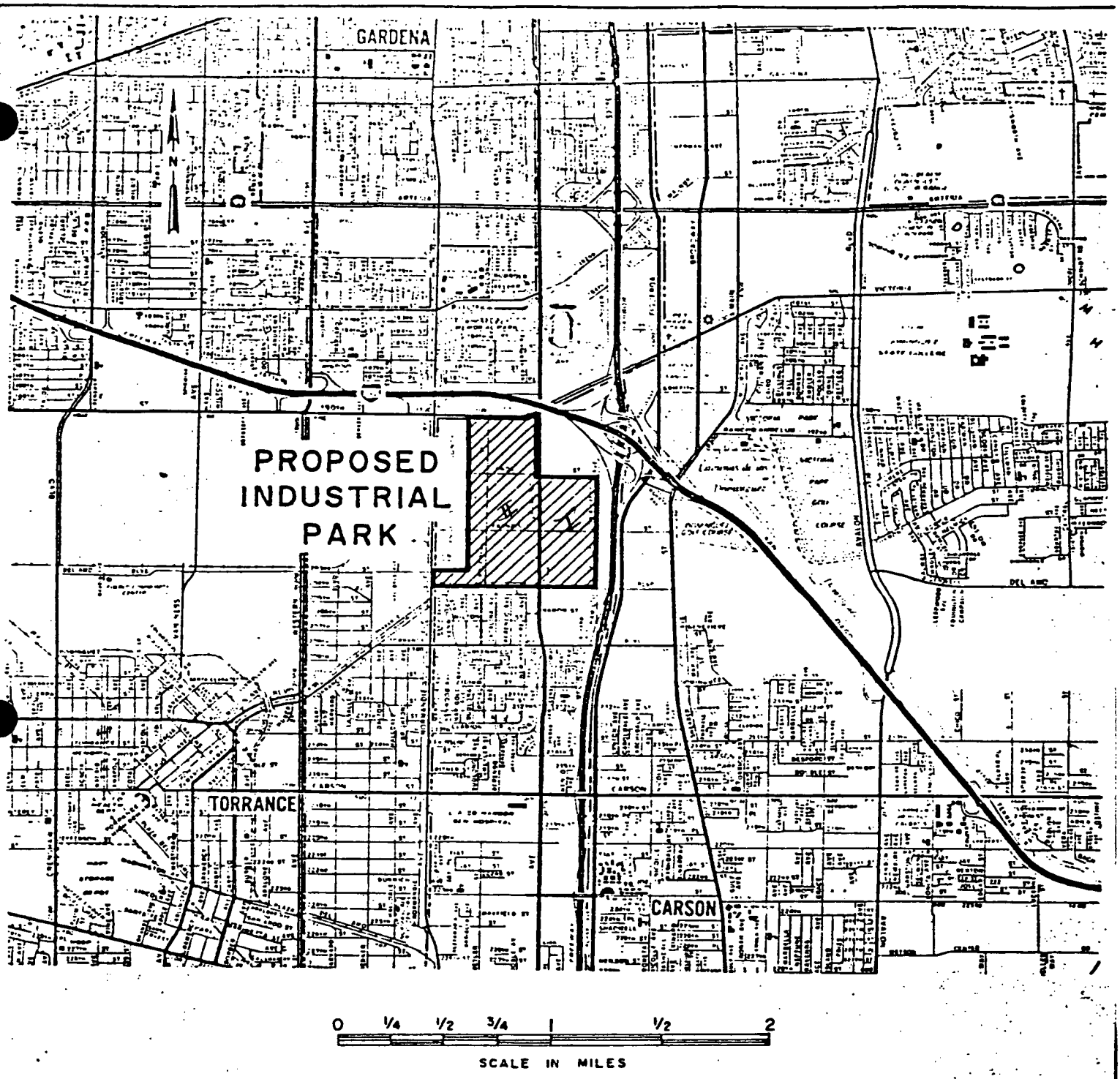
SHELL CHEMICAL PLANT PROPERTY

Los Angeles, California

DRWN BY: B.J.A.	DATE: 9-21-72	JOB NO.	PLATE NO.
CHKD. BY: H.L.T.	DATE: 9-21-72	7298	1

KEN O'BRIEN & ASSOCIATES

CONSULTING ENGINEERS



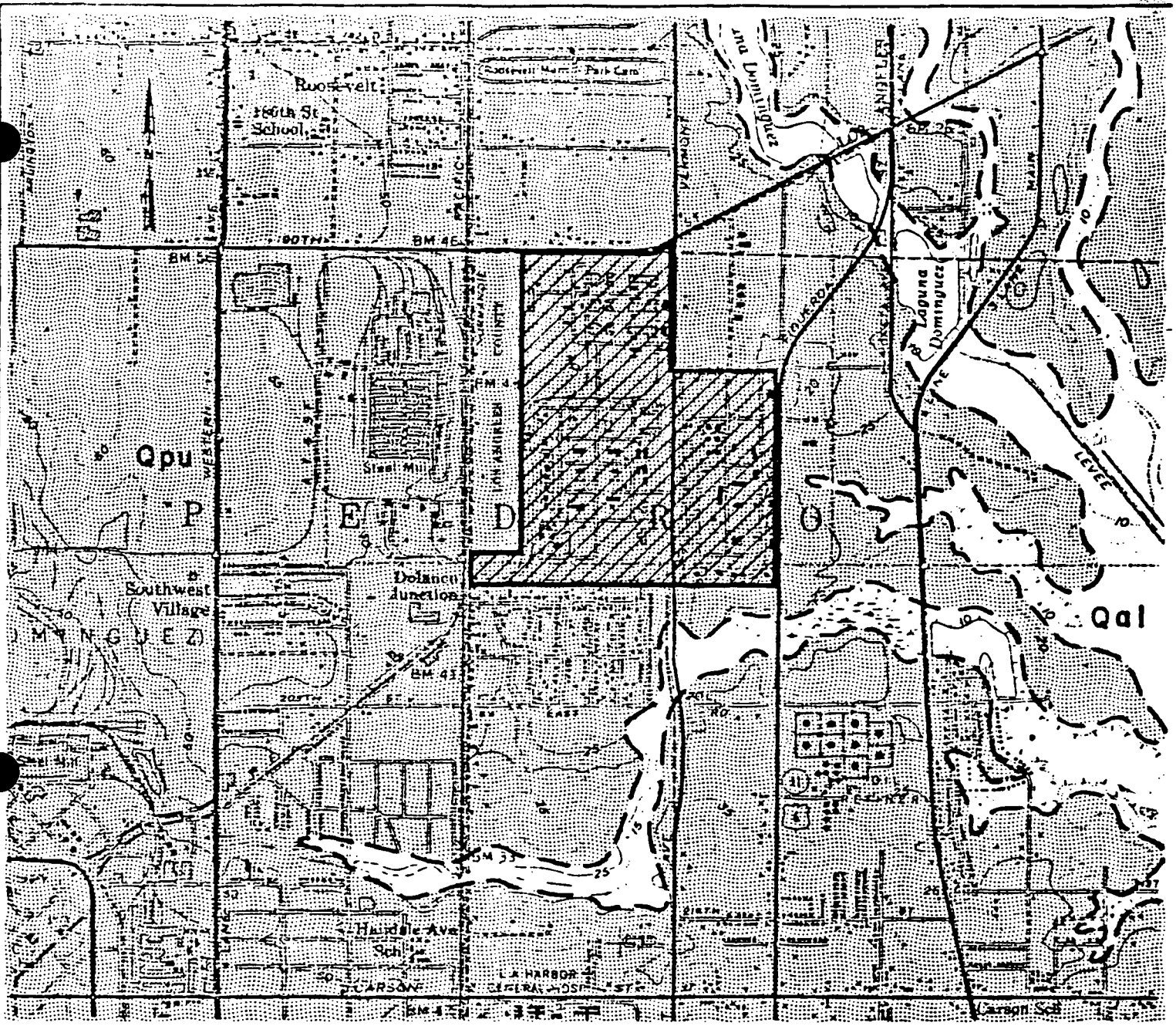
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.

LOCATION MAP

SHELL CHEMICAL PLANT PROPERTY
Los Angeles, California

DRWN BY: V.R.W.	DATE: 9-14-72	JOB NO.	PLATE NO.
CHKD. BY: H.L.T.	DATE: 9-20-72	7298	2

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



LEGEND

Qal	ALLUVIAL & COASTAL DEPOSITS (RECENT)
Qpu	TERRACE COVER OR PALOS VERDES SAND (UPPER PLEISTOCENE)
— — —	GEOLOGIC CONTACT
	PROPOSED INDUSTRIAL PARK

REFERENCES:

1. U.S.G.S. WATER SUPPLY PAPER 1461
2. TORRANCE QUADRANGLE MAP 7.5 Minute Series (Topographic)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.

GEOLOGIC MAP

SHELL CHEMICAL PLANT PROPERTY

Los Angeles, California

DRWN BY: V.R.W.	DATE: 9-14-72	JOB NO.	PLATE NO.
CHKD. BY: H.L.T.	DATE: 9-20-72	7298	4

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CONSULTING ENGINEERS

CONTAMINATED AREA NO. 3

SCALE: 1"=100'

℄ AVENJE B

DW&P TOWER

100'

DW&P TOWER

℄ DW&P RIGHT-OF-WAY

400'

100' CONTAMINATED AREA NO. 2

$U_2 = 400(100)(25)/27 \cong 37{,}000$ cu yds

#1

$U_1 + U_2 \cong 63{,}000$ cu yds

700'

100'

CONTAMINATED AREA NO. 1

$U_1 = lwd/27 = 700(100)(10)/27 \cong 26{,}000$ cu yds

300' TO ℄ OF VERMONT AVE.

1010' TO ℄ OF VERMONT AVE.

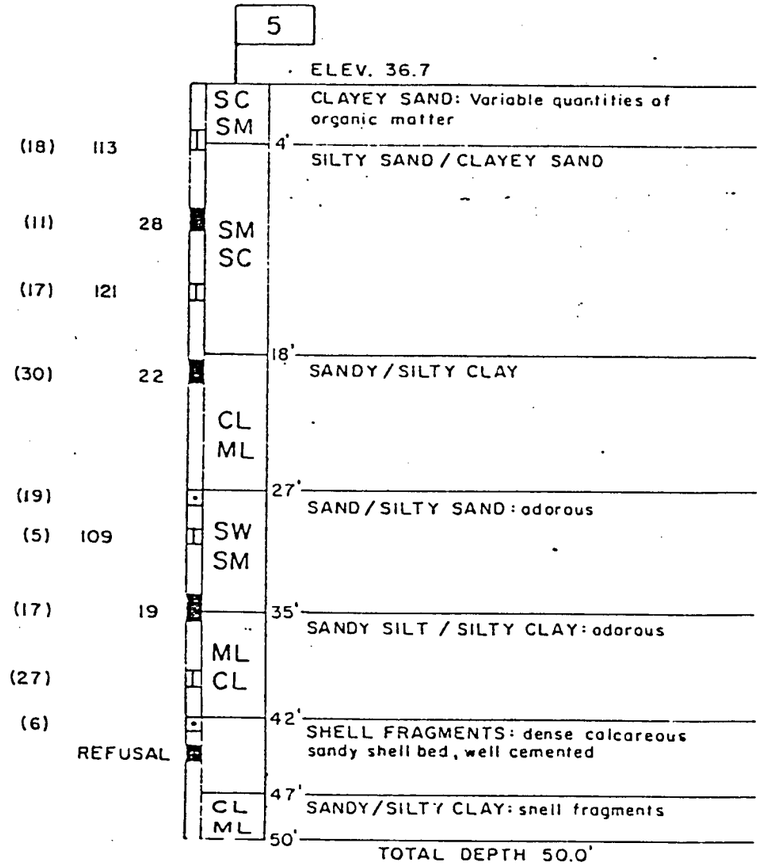
EXISTING PROPERTY LINE

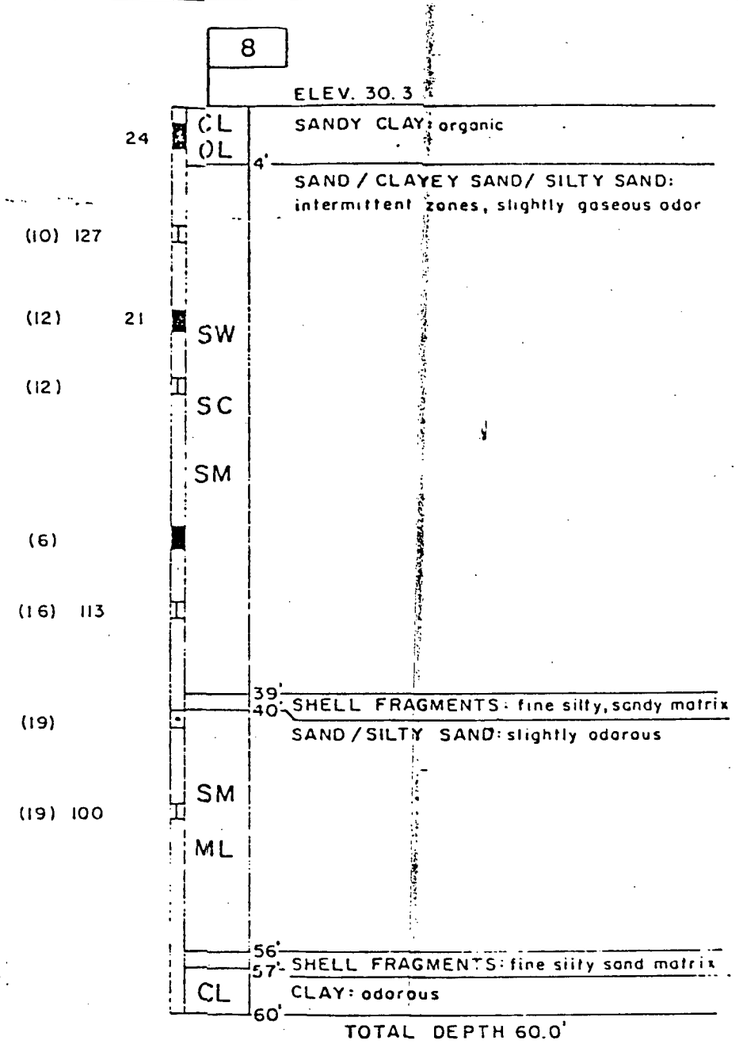
℄ DEL AMO BOULEVARD

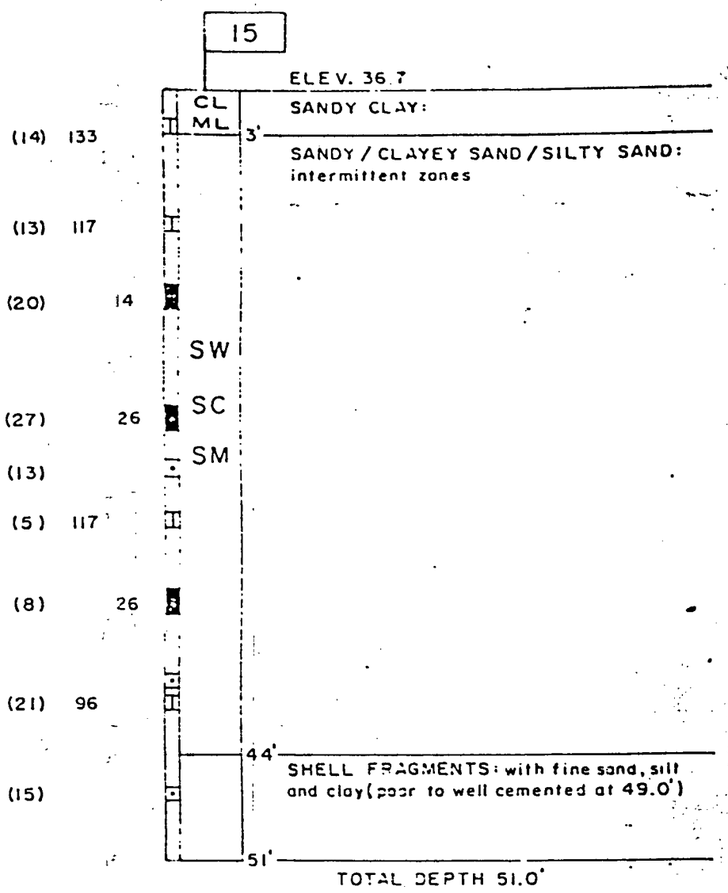
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
PLAN VIEW
CONTAMINATED AREA NO'S. 1,2 & 3
SHELL CHEMICAL PLANT PROPERTY
Los Angeles, California

DRWN BY: B.J.A.	DATE: 9-21-72	JOB NO.	PLATE NO.
CHKD. BY: H.L.T.	DATE: 9-21-72	7298	7

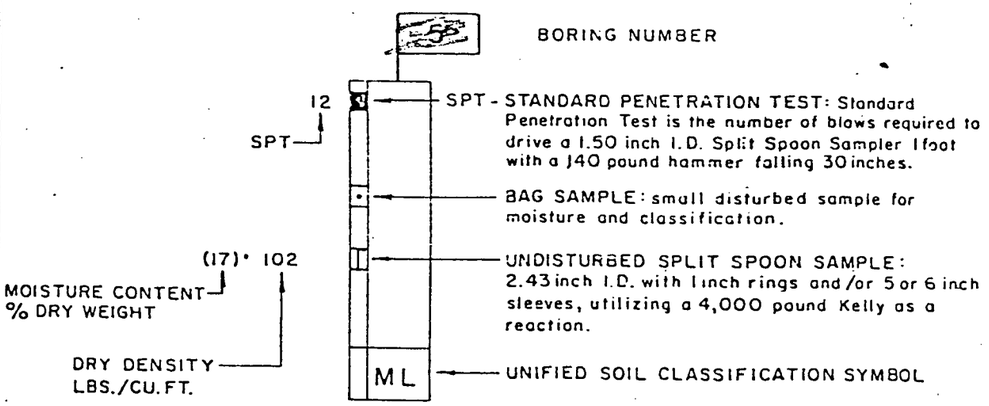
KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS







LEGEND



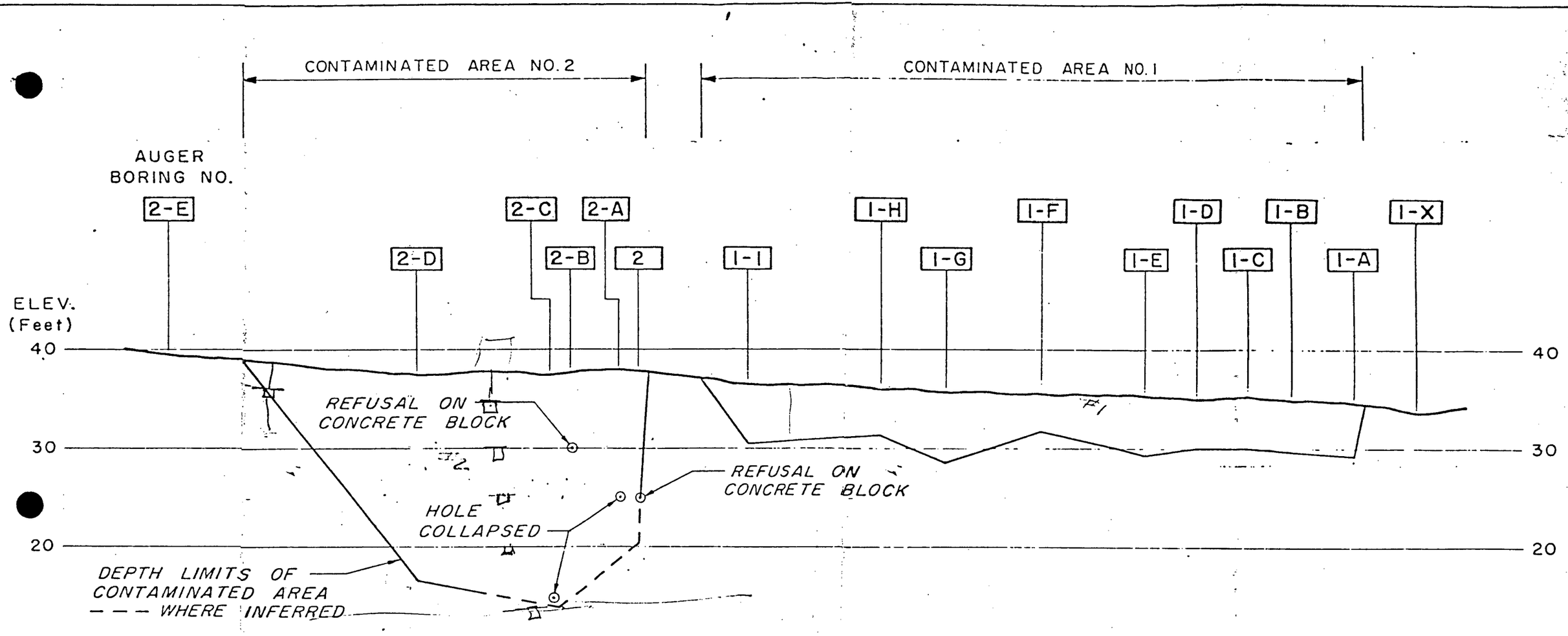
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.

TYPICAL SUBSURFACE SOIL CONDITIONS

SHELL CHEMICAL PLANT PROPERTY
Los Angeles, California

DRWN BY: B.&A.	DATE: 9-21-72	JOB NO.	PLATE NO.
CHKD. BY: H.L.T.	DATE: 9-21-72	7298	6

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



SCALE

VERTICAL — 1 Inch = 10 FEET
HORIZONTAL — 1 Inch = 100 FEET

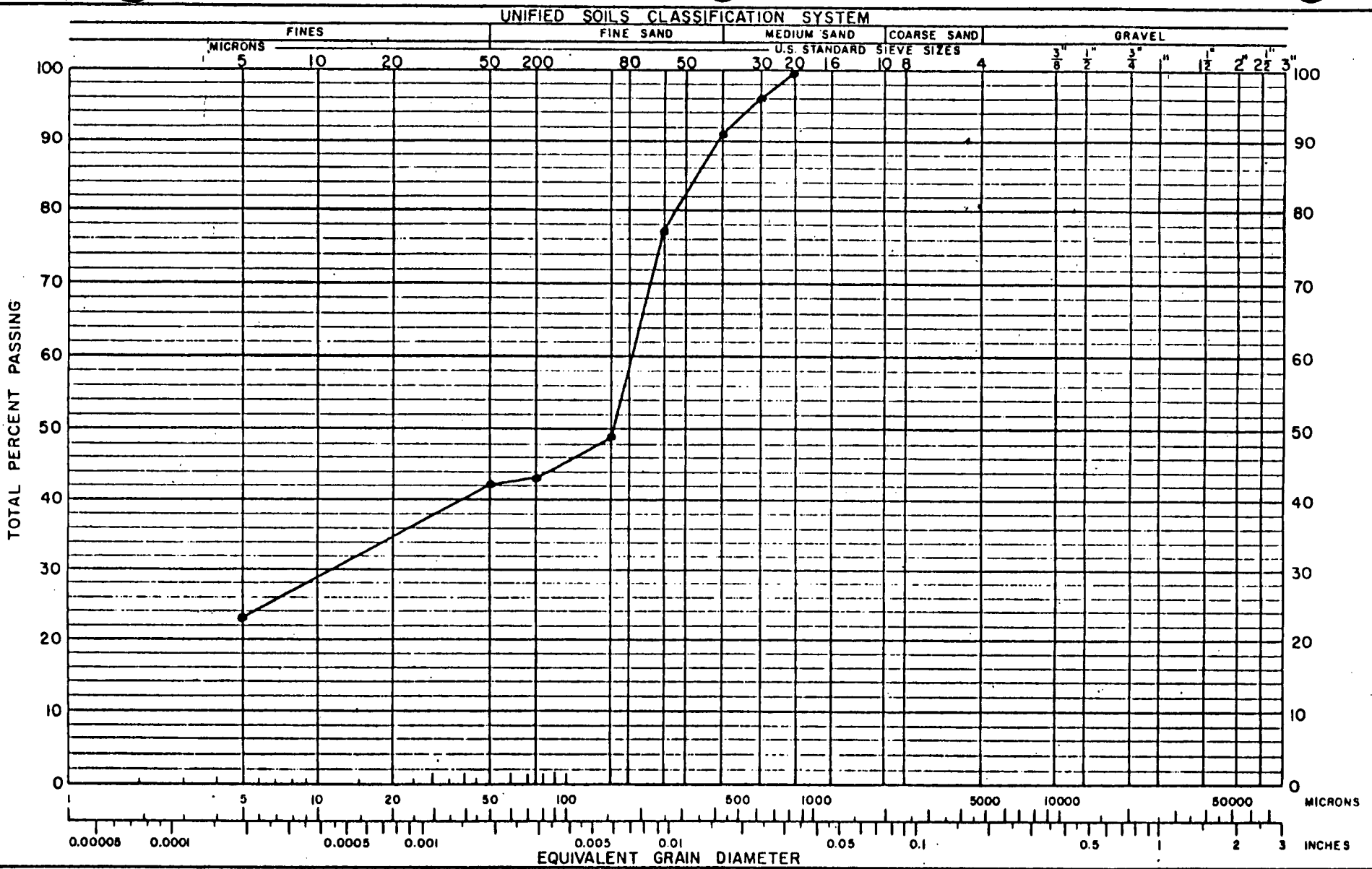
G C/INC #20

NOTE:
REFER TO PLATE NO. 7 FOR AREAL EXTENT

CABOT, CABOT & FORBES
C.C.& F. WESTERN DEVELOPMENT CO., INC.
PROFILE
CONTAMINATED AREA NO'S. 1&2
SHELL CHEMICAL PLANT PROPERTY
Los Angeles, California

DRWN BY: V.R.W.	DATE: 9-14-72	JOB NO.	PLATE NO.
CHKD. BY: H.L.T.	DATE: 9-20-72	7298	8

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



Sample Boring No. 6 Depth: 8.5'

% Sand 58
% Silt 19
% Clay 23
CLAYEY SAND (SC-SM)

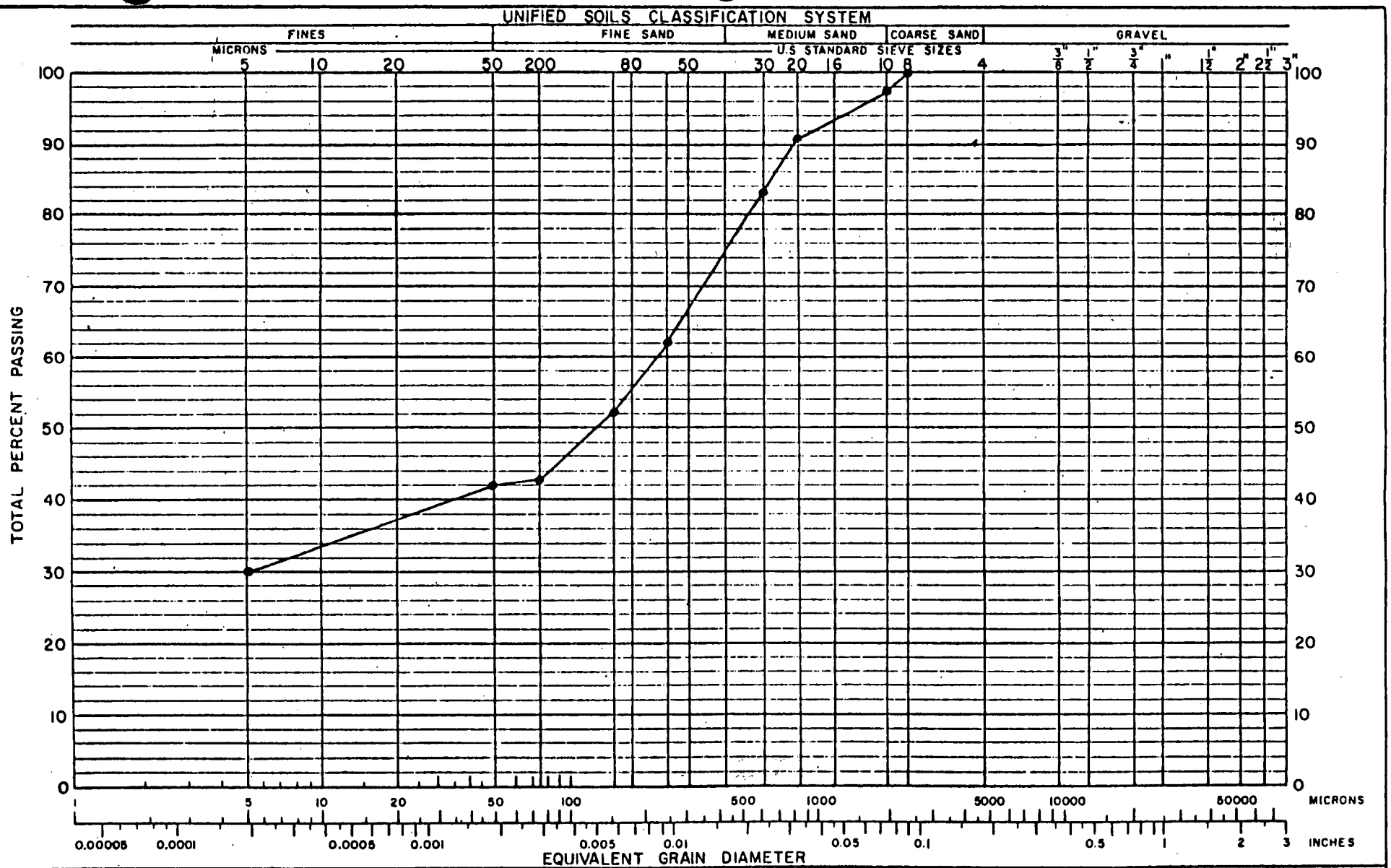
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 13

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

K.O.&A. FORM-6



Sample Boring No. 6 Depth: 18.5'

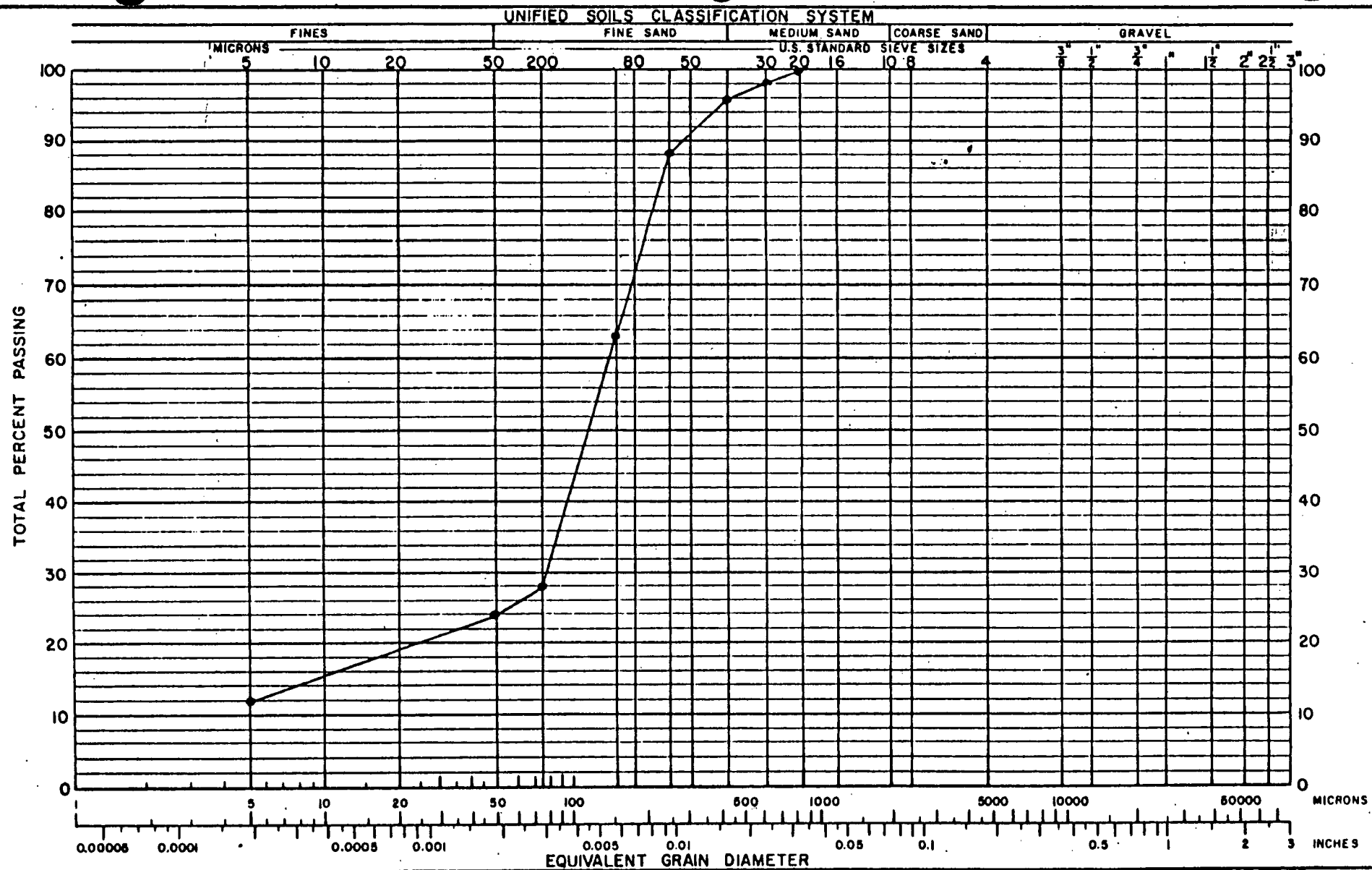
% Sand 58
% Silt 11
% Clay 31
SANDY CLAY (CL)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 14

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



Sample Boring No. 6 Depth: 24.0'

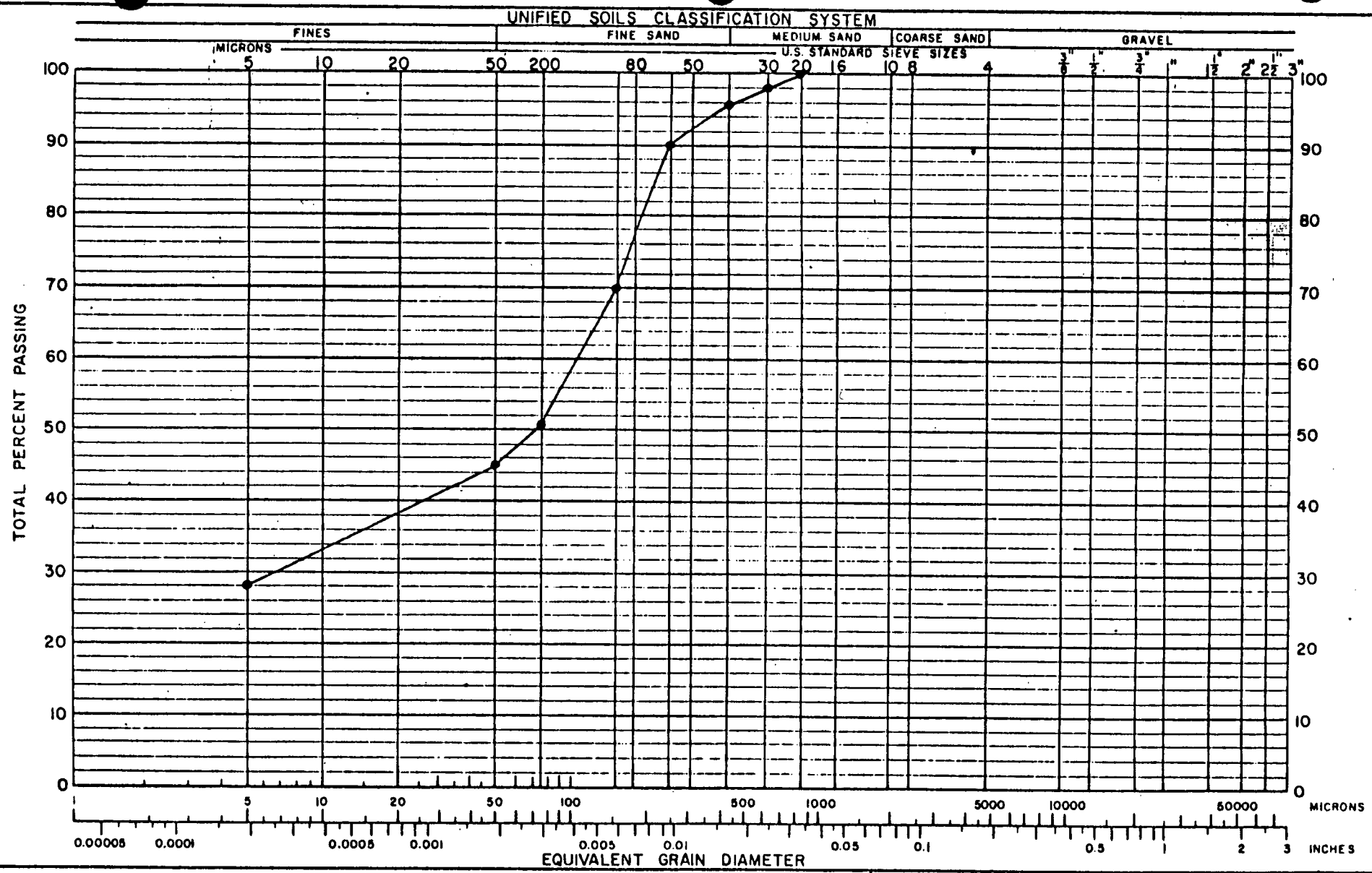
% Sand 76
% Silt 12
% Clay 12
CLAYEY SAND (SC-SM)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 15

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



Sample Boring No. 7 Depth: 3.5'

% Sand 55
% Silt 17
% Clay 28
CLAYEY SAND (SC-SM)

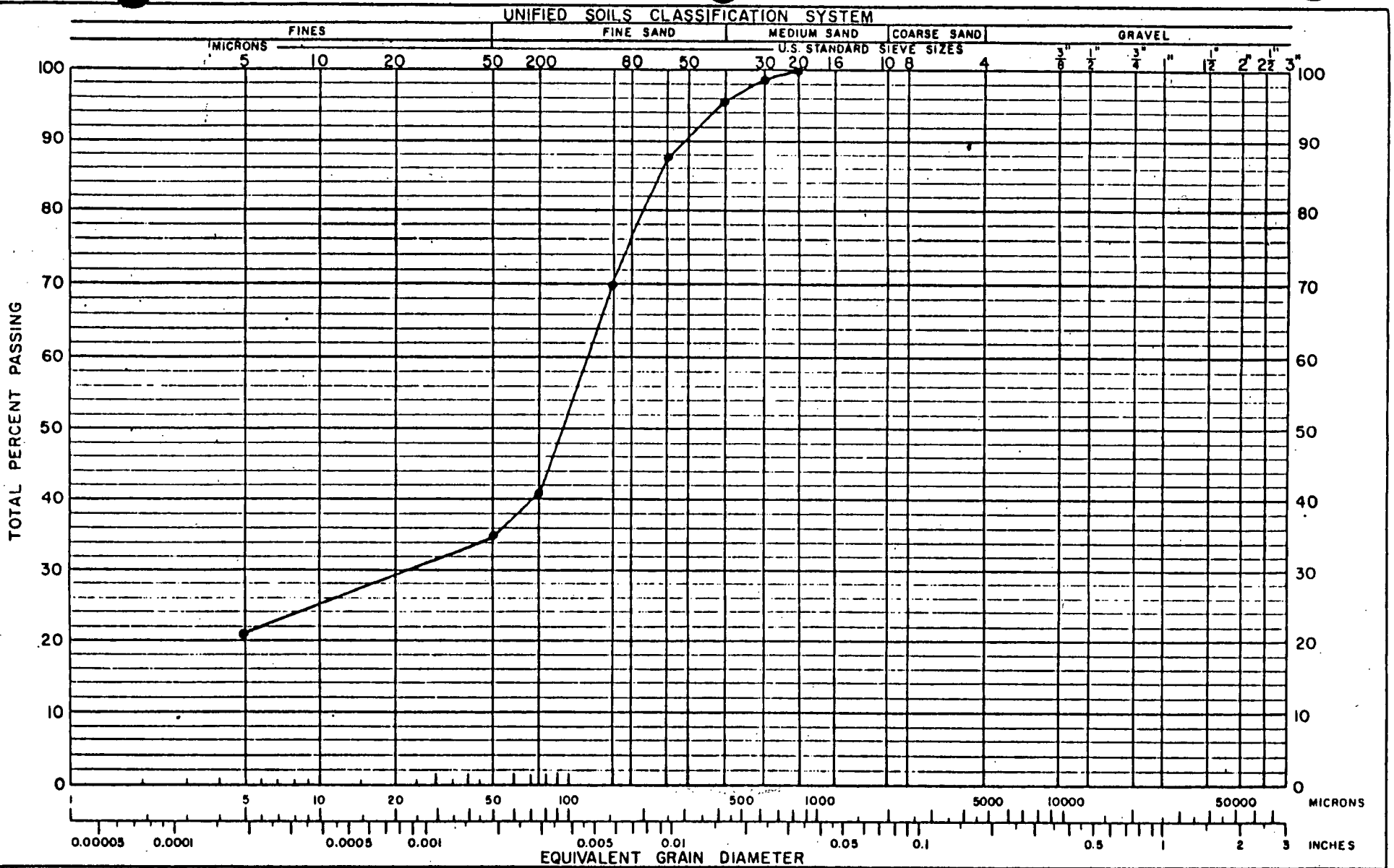
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 16

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

K.O.&A. FORM-6



Sample Boring No. 10 Depth: 8.5'

% Sand 65
% Silt 14
% Clay 21
CLAYEY SAND (SC-SM)

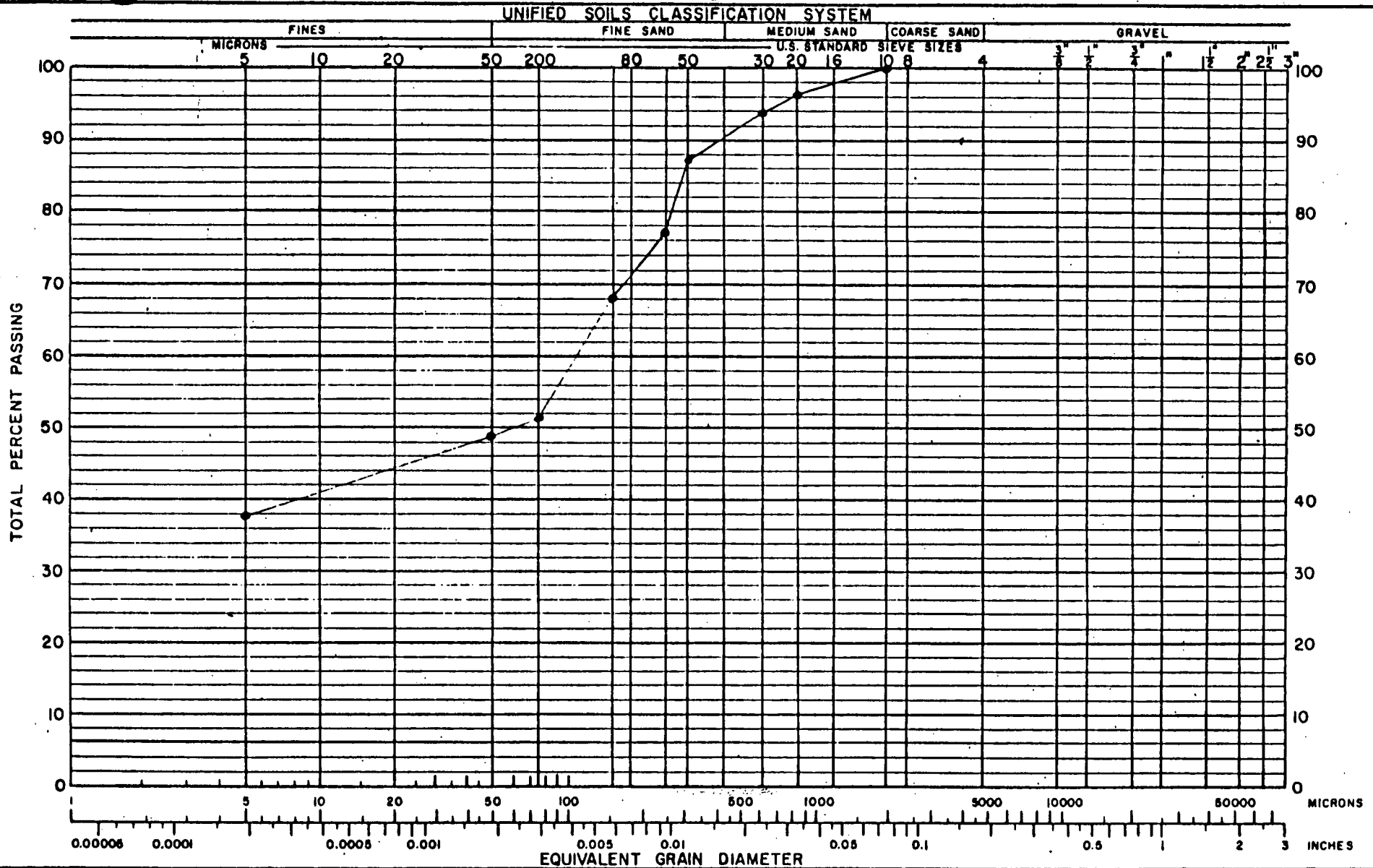
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 17

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

K.O.&A. FORM-6



Sample Boring No. 14 Depth: 3.5'

% Sand 51
% Silt 11
% Clay 33
SANDY CLAY (CL)

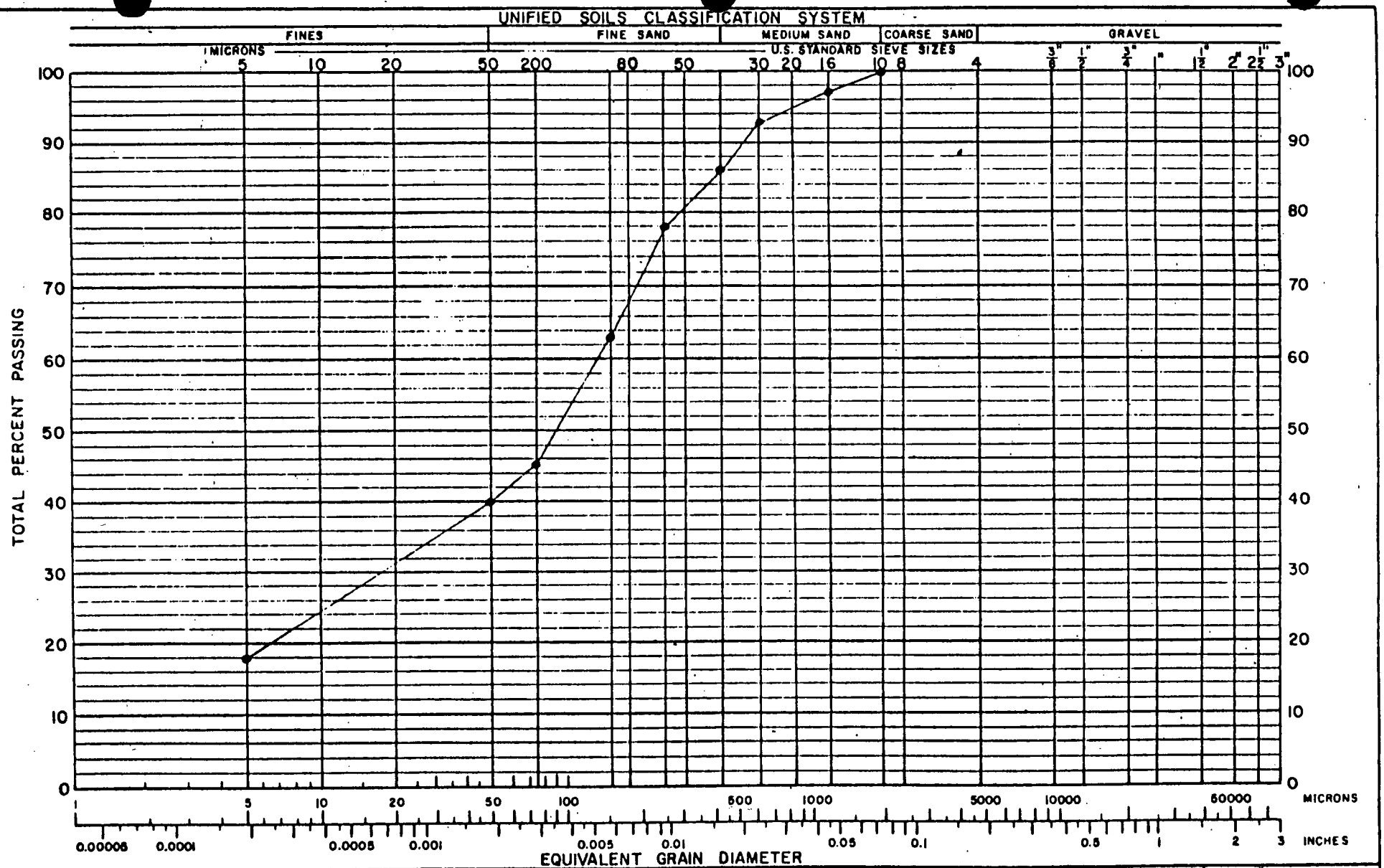
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 18

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

K.O.&A. FORM-6



Sample Boring No. 15 . Depth: 8.5'

% Sand 60
% Silt 22
% Clay 18
CLAYEY SAND (SC-SM)

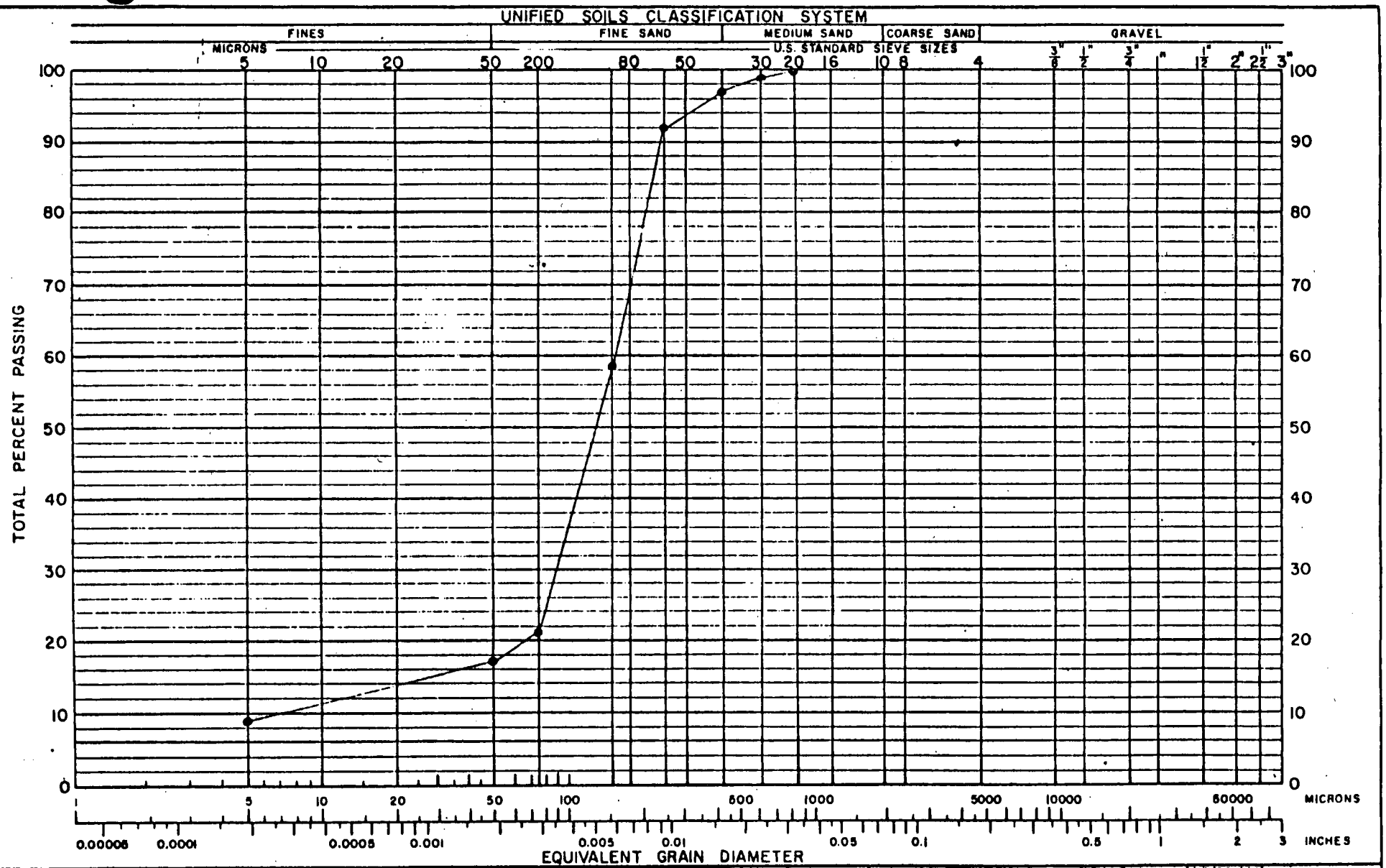
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 19

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

KOBA FORM-6



Sample Boring No. 18 Depth: 13.5'

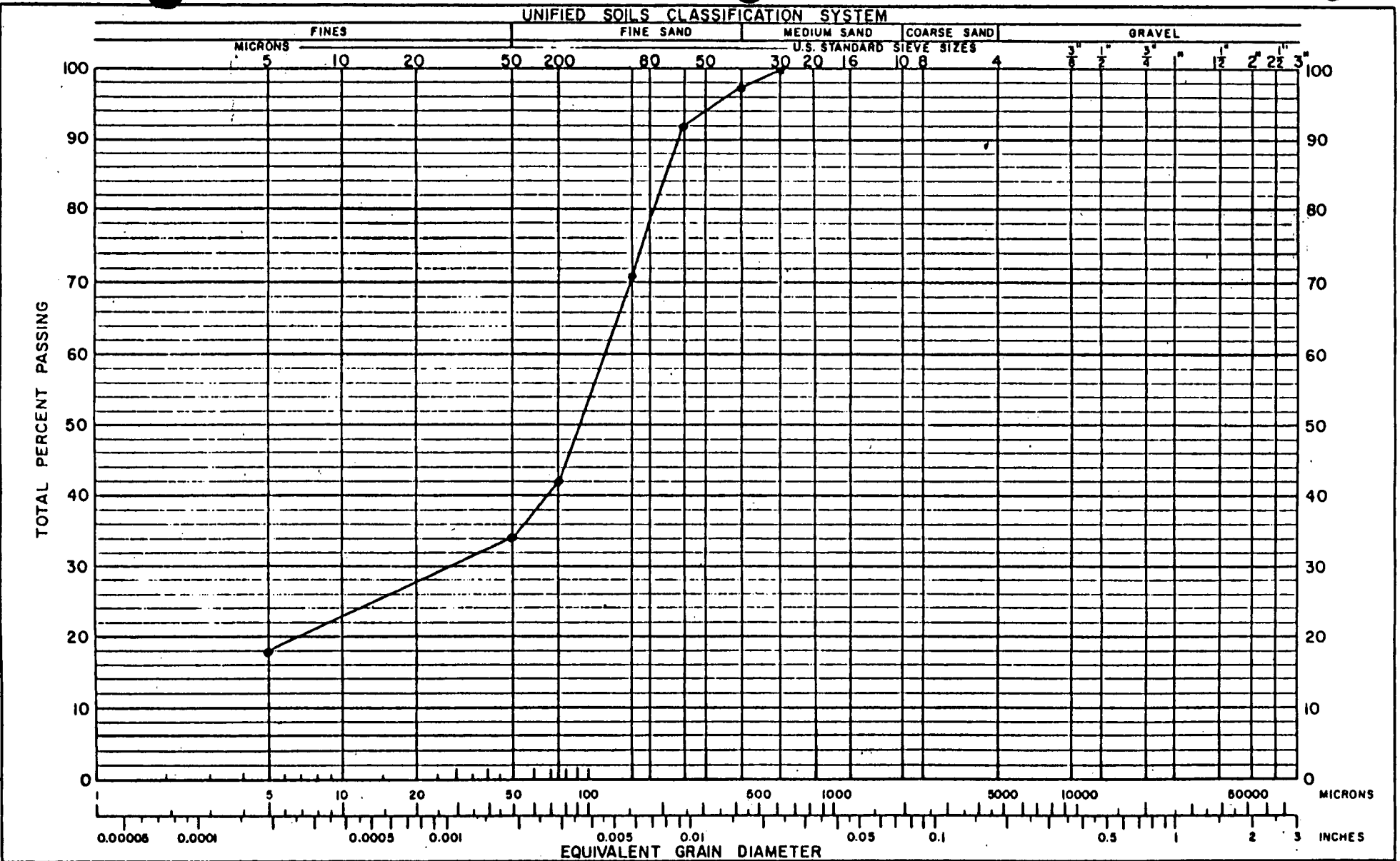
% Sand 83
% Silt 8
% Clay 9
SAND (SP)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 20

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



Sample Boring No. 19 Depth: 8.5'

% Sand 66
% Silt 16
% Clay 18
CLAYEY SAND (SC-SM)

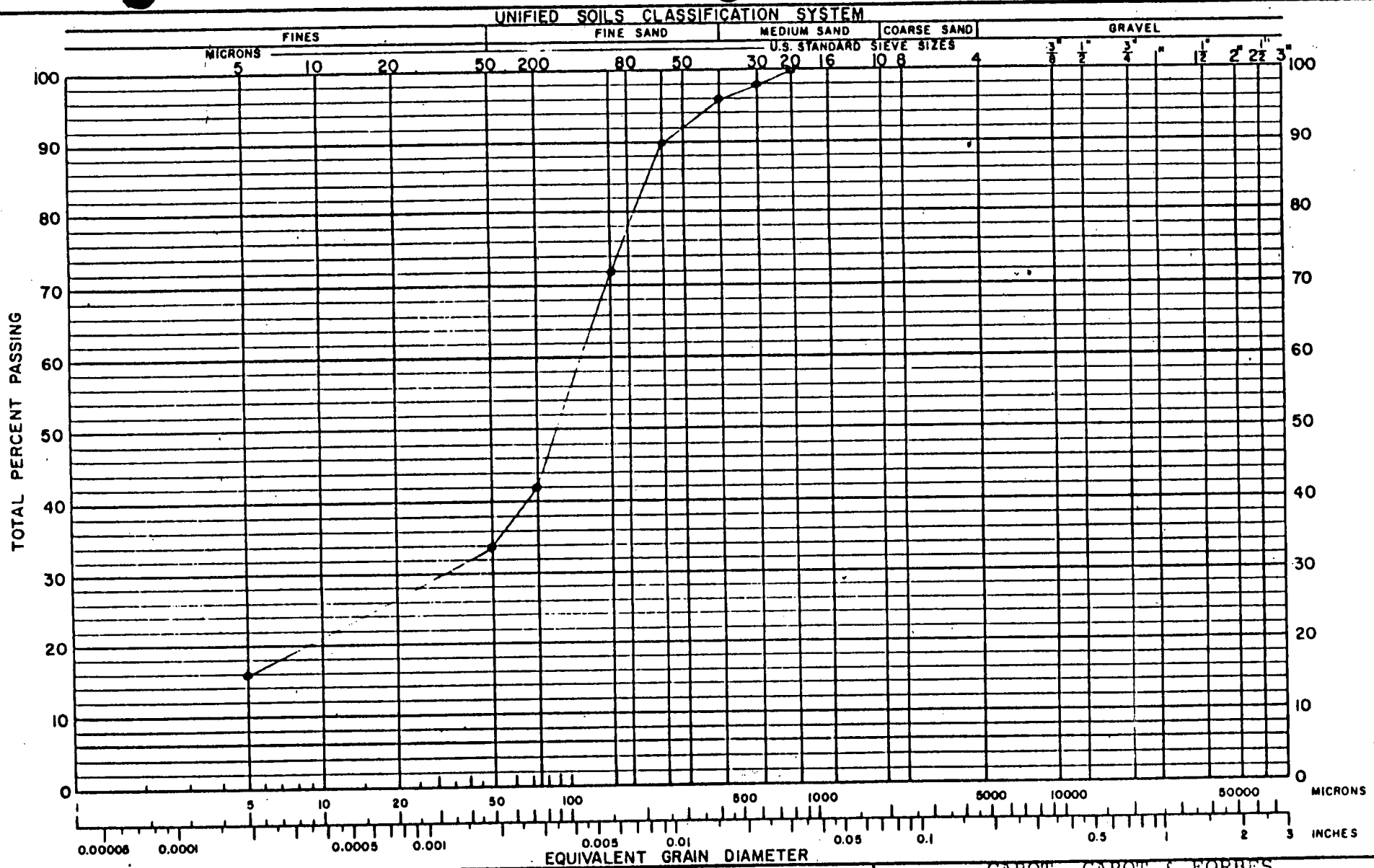
CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 21

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

KOBA FORM-6



Sample Boring No. 20 Depth: 6.0'

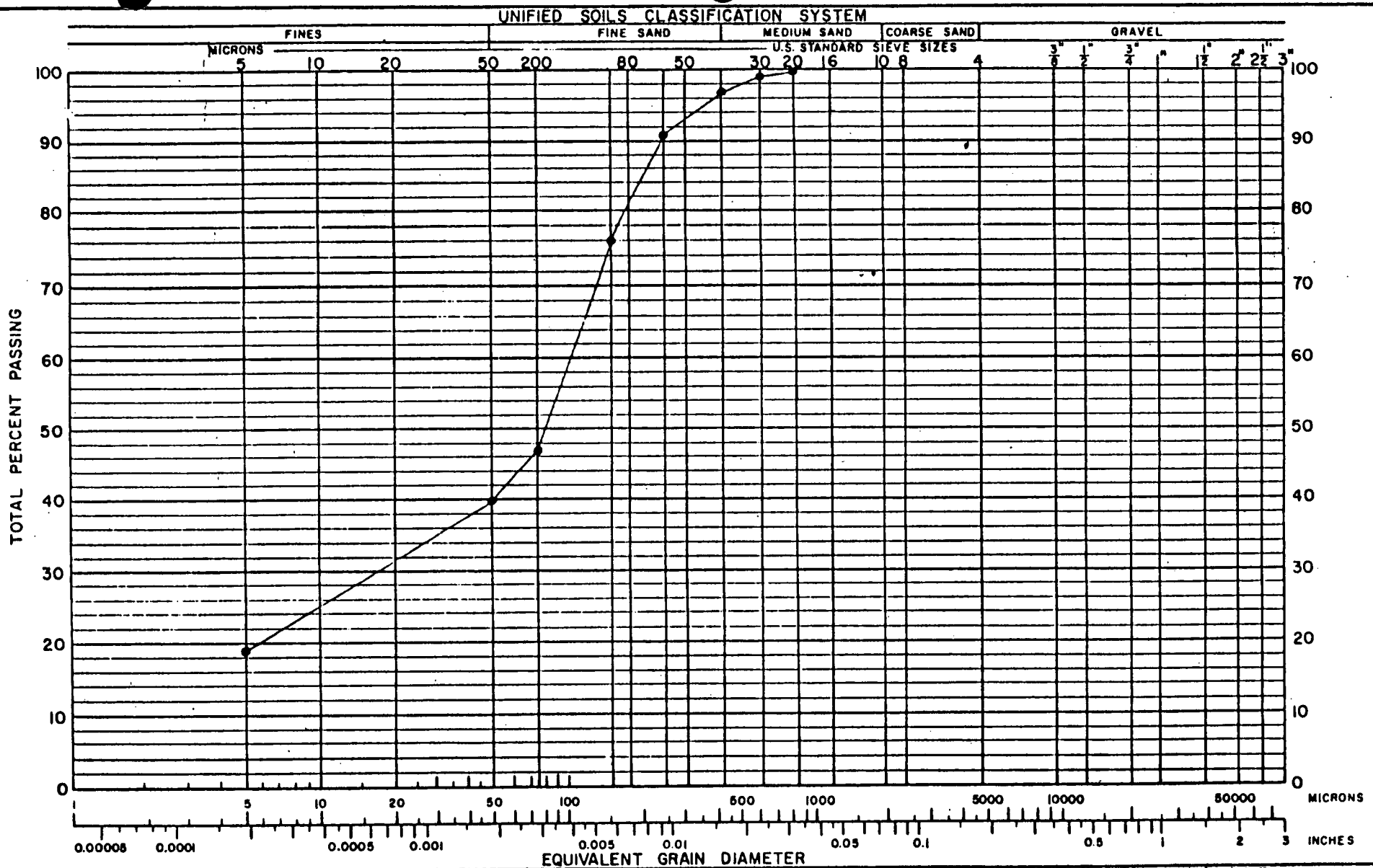
% Sand 66
% Silt 18
% Clay 16
CLAYEY SAND (SC-SM)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 22

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



Sample Boring No. 22 Depth: 4.0'

% Sand 60
% Silt 21
% Clay 19
CLAYEY SAND (SC-SM)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 23

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

NOAA FORM-6

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

ATTERBERG LIMITS

Boring No.	Depth of Sample	Soil Class	Liquid Limit	Plastic Limit	Plasticity Index
1	3.5	LEAN CLAY	37	17	20
3	3.5	SANDY CLAY	43	20	23
5	3.5	CLAYEY SAND	35	17	18
6	3.5	LEAN CLAY	36	16	20
6	13.5	SILTY SAND	20.7	N/A	N/A
16	4.5	SANDY CLAY	32	22	10

EXPANSION TEST AND DIRECT SHEAR TEST

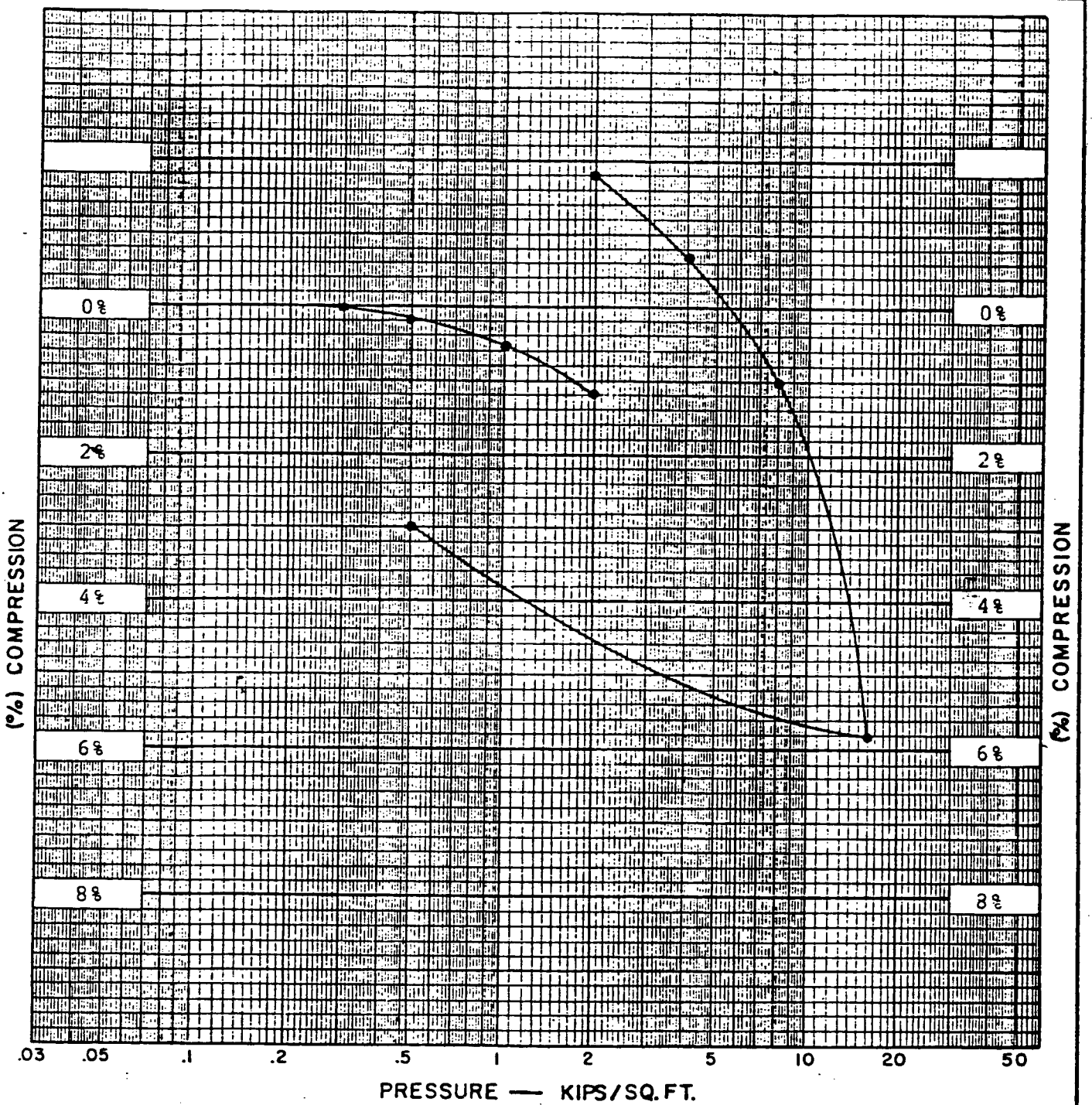
Boring No.	Depth of Sample	Soil Class	Percent Expansion	Cohesion (lbs/ft^2)	Angle of Internal Friction
6	3.5	LEAN CLAY	0.95	1,200	24
7	3.5	CLAYEY SAND	0.44	1,100	26
10	8.5	CLAYEY SAND	0.75	900	30
11	8.5	SILTY SAND	0.23	800	32
15	8.5	CLAYEY SAND	0.75	1,400	26
16	4.5	SANDY CLAY	0.76	1,450	28
20	6.0	CLAYEY SAND	0.23	1,400	24
22	4.0	CLAYEY SAND	0.29	1,300	29

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

UNCONFINED COMPRESSION TEST RESULTS

Boring No.	Depth to Sample	Soil Classification	Strength--Ksf
6	3.5'	LEAN CLAY	4.0
7	3.5'	CLAYEY SAND	8.8
10	8.5'	CLAYEY SAND	5.1
11	8.5'	SILTY SAND	8.8
15	8.5'	CLAYEY SAND	12.4
16	4.5'	SANDY CLAY	10.2
20	6.0'	CLAYEY SAND	3.1
22	4.0'	CLAYEY SAND	6.2

NOTE: Refer to Plate No's. 5 and 6 for boring locations and typical subsurface soil conditions.



TEST DATA

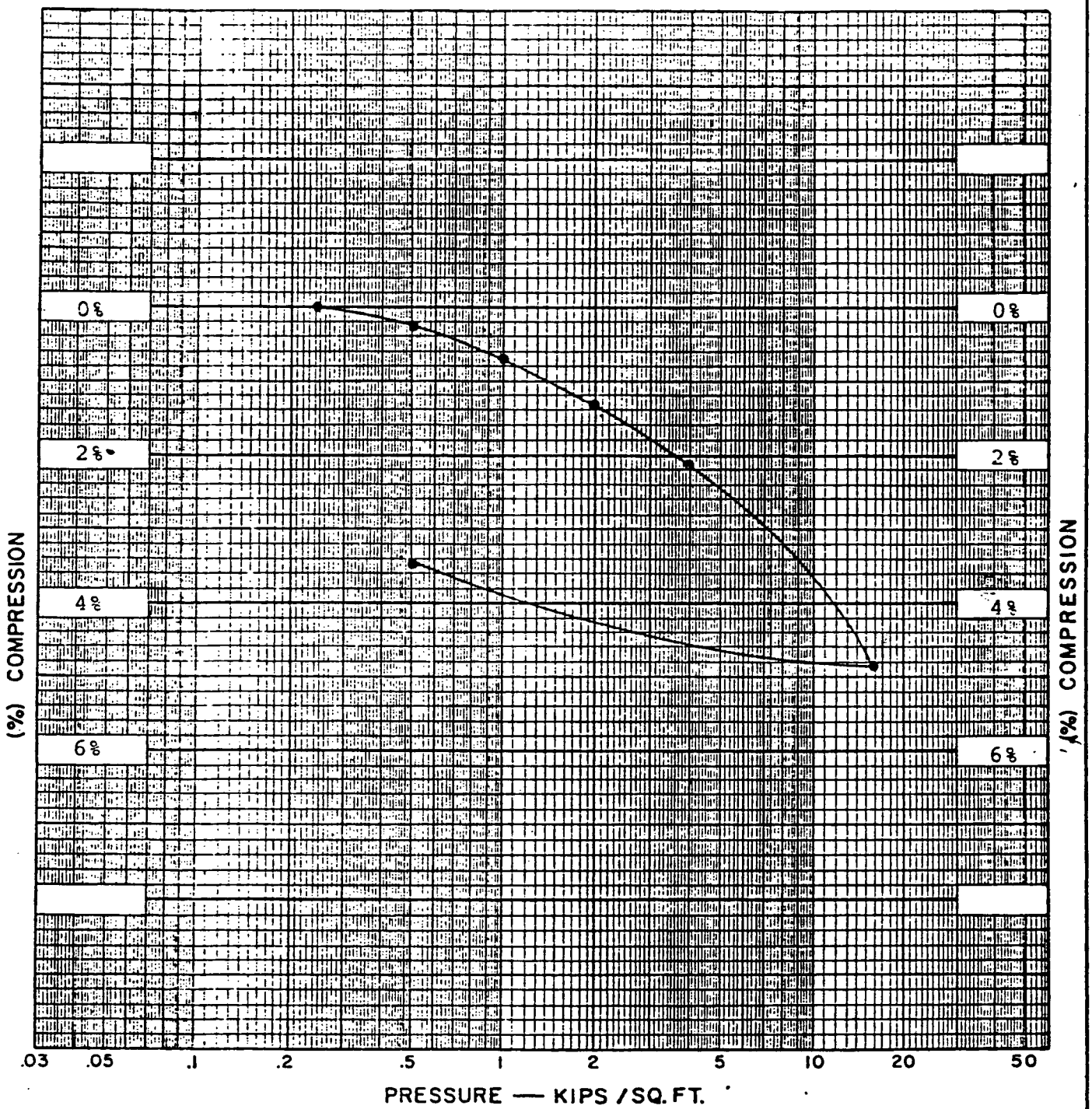
BORING NUMBER 6
SAMPLE NUMBER
DEPTH (FEET) 3.5
CLASSIFICATION (CL-OL) LEAN CLAY
HEIGHT (INCHES)
DIAMETER (INCHES)
INITIAL MOISTURE CONTENT (%) 16
INITIAL DRY DENSITY (LB./CU. FT. 113
SPECIFIC GRAVITY
FINAL MOISTURE CONTENT (%)
LIQUID LIMIT 36
PLASTIC INDEX 20

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

CONSOLIDATION TEST

DR. BY:	DATE:	PROJECT	PLATE NO.
CHK. BY: W.D.	DATE: 9/17/72	7298	26

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



TEST DATA

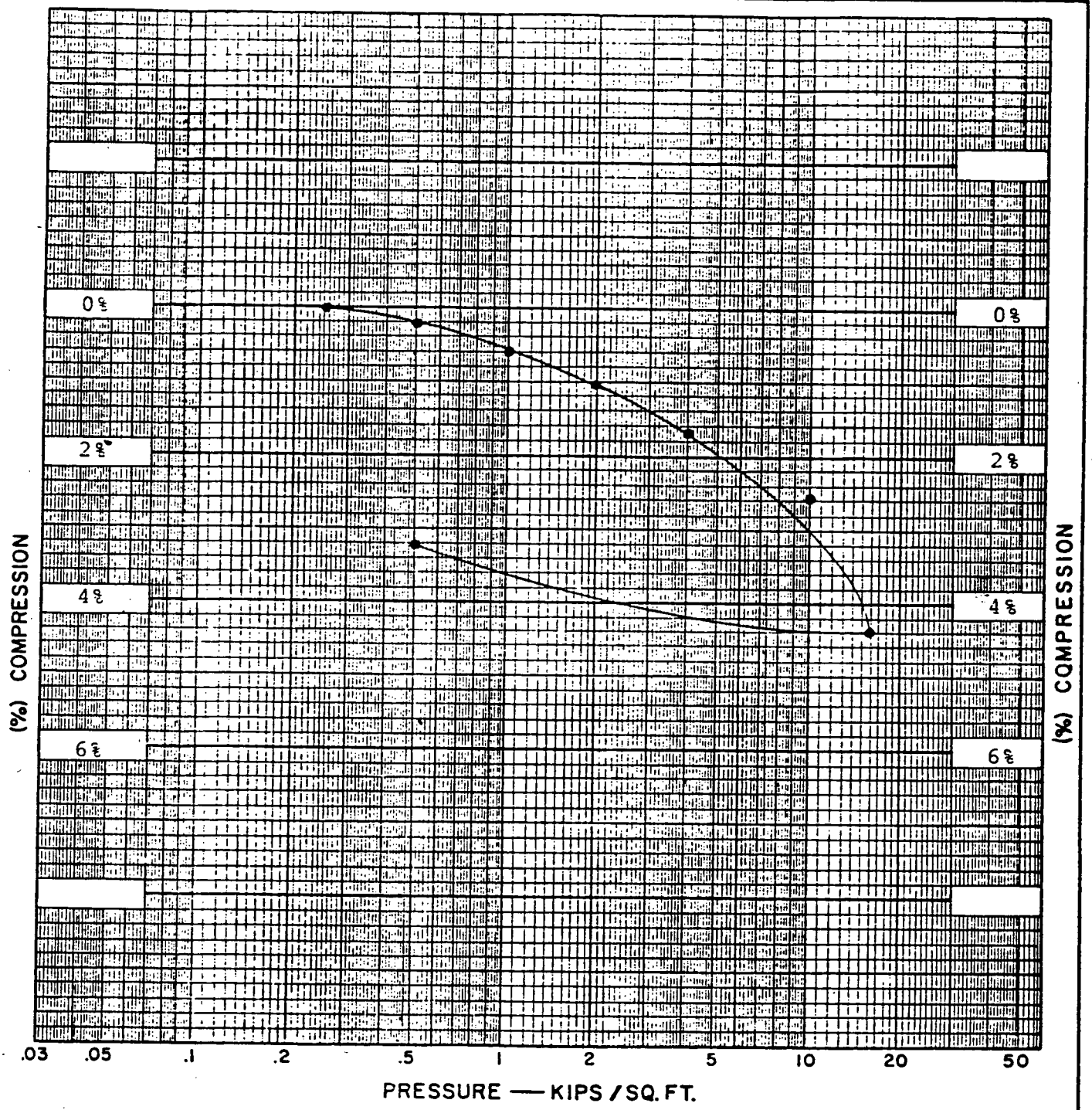
BORING NUMBER 6
SAMPLE NUMBER
DEPTH (FEET) 13.5
CLASSIFICATION (SM) SILTY SAND
HEIGHT (INCHES)
DIAMETER (INCHES)
INITIAL MOISTURE CONTENT (%) 13
INITIAL DRY DENSITY (LB./CU. FT. 110
SPECIFIC GRAVITY
FINAL MOISTURE CONTENT (%)
LIQUID LIMIT
PLASTIC INDEX

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

CONSOLIDATION TEST

DR. BY:	DATE:	PROJECT	PLATE NO.
CHK. BY: W.D.	DATE 9/17/72	7298	27

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



TEST DATA

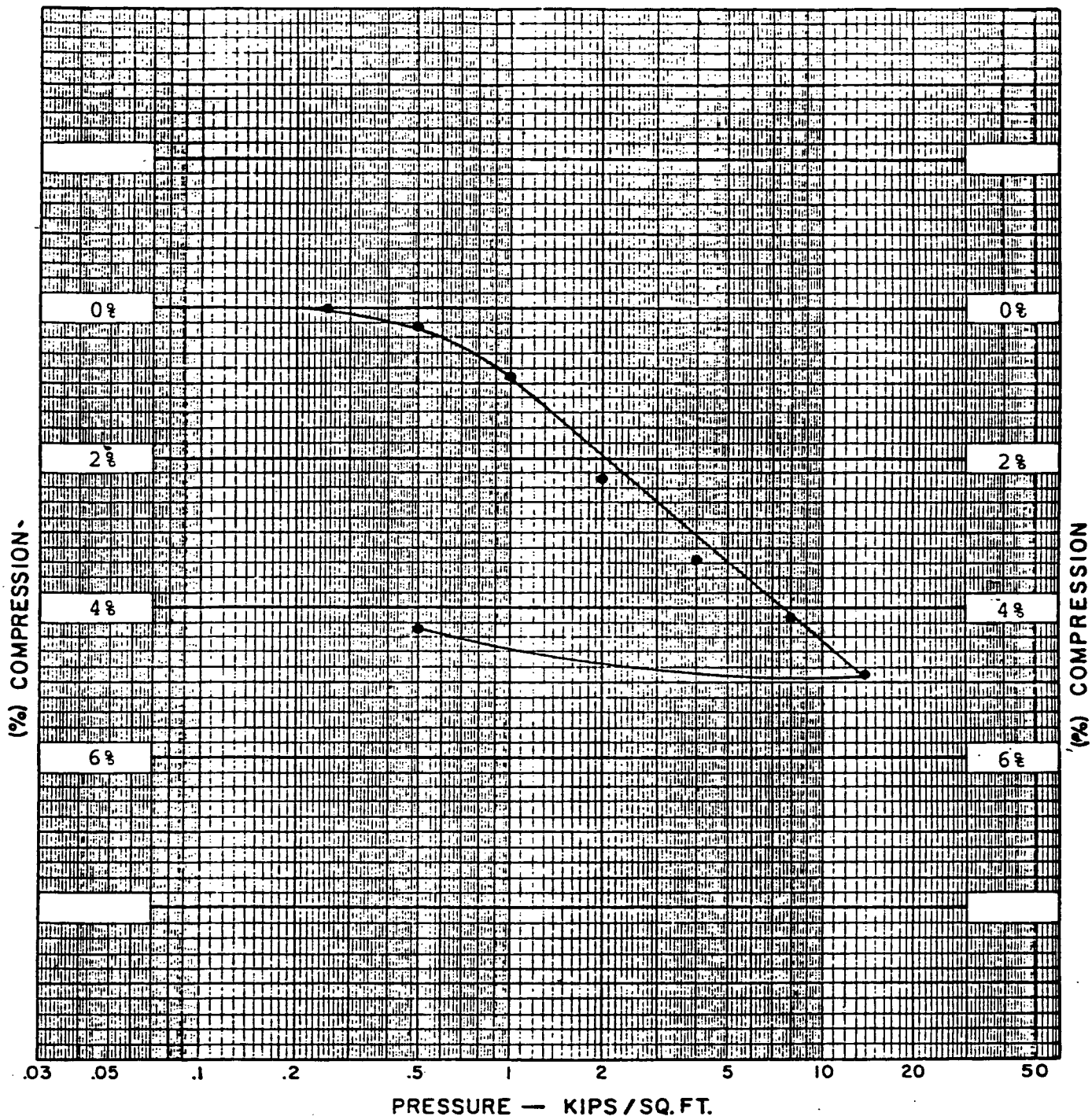
BORING NUMBER 15
SAMPLE NUMBER
DEPTH (FEET) 8.5
CLASSIFICATION (SC-SM) CLAYEY SAND
HEIGHT (INCHES)
DIAMETER (INCHES)
INITIAL MOISTURE CONTENT (%) 12
INITIAL DRY DENSITY (LB./CU. FT. 117
SPECIFIC GRAVITY
FINAL MOISTURE CONTENT (%)
LIQUID LIMIT
PLASTIC INDEX

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

CONSOLIDATION TEST

DR. BY:	DATE:	PROJECT	PLATE NO.
CHK. BY: U.D.	DATE: 9/17/72	7298	28

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



TEST DATA

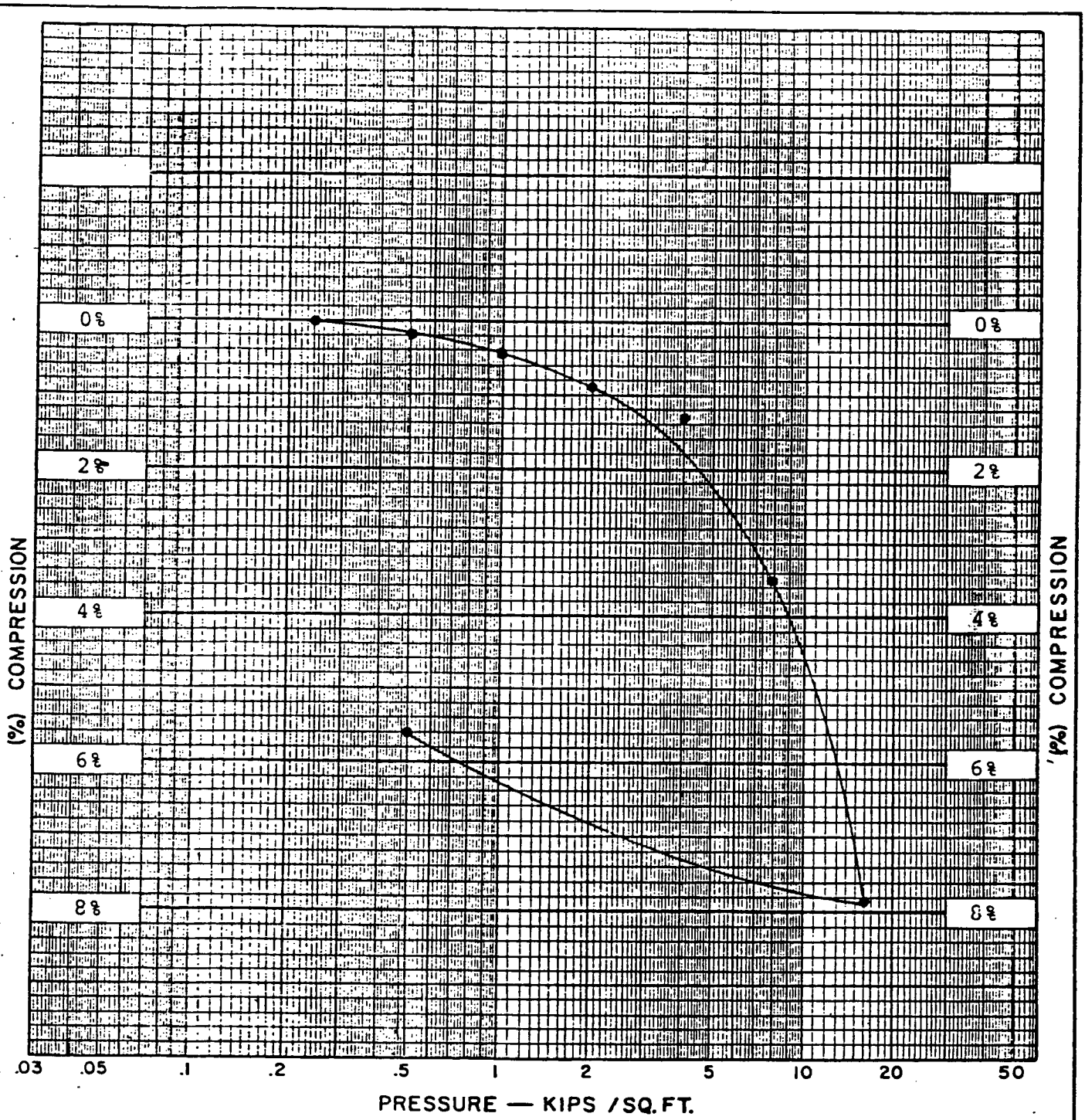
BORING NUMBER 16
SAMPLE NUMBER
DEPTH (FEET) 4.5
CLASSIFICATION (CL) SANDY CLAY
HEIGHT (INCHES)
DIAMETER (INCHES)
INITIAL MOISTURE CONTENT (%) 16
INITIAL DRY DENSITY (LB./CU. FT. 118
SPECIFIC GRAVITY
FINAL MOISTURE CONTENT (%)
LIQUID LIMIT 32
PLASTIC INDEX 10

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

CONSOLIDATION TEST

DR. BY:	DATE:	PROJECT	PLATE NO.
CHK. BY: W.D.	DATE: 9/17/72	7298	29

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



TEST DATA

BORING NUMBER 20
SAMPLE NUMBER
DEPTH (FEET) 6.0
CLASSIFICATION (SC-SM) CLAYEY SAND
HEIGHT (INCHES)
DIAMETER (INCHES)
INITIAL MOISTURE CONTENT (%) 16
INITIAL DRY DENSITY (LB./CU. FT.) 111
SPECIFIC GRAVITY
FINAL MOISTURE CONTENT (%)
LIQUID LIMIT
PLASTIC INDEX

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

CONSOLIDATION TEST

DR. BY:	DATE:	PROJECT	PLATE NO.
CHK. BY: W.D.	DATE 9/17/72	7298	30

KEN O'BRIEN & ASSOCIATES
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BORING LEGEND

SPT	Standard Penetration Test
Penetration Resistance - 3	Number of blows required to drive 1.50-inch I.D. split spoon sampler 6 inches with a 140-pound hammer falling 30 inches.
SS	2.43-inch I.D. split spoon sampler with 1-inch rings and/or 5- or 6-inch sleeves, utilizing a 4,000-pound Kelly as a reaction.
B	Bag Sample
(18)	Moisture Content - % dry weight
(SC-SM)	Unified Soil Classification

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LOG OF BORING 1

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 33.5'	DATE OF BORING: STARTED 8-14-72; COMPLETED 8-14-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE (MOISTURE CONTENT % — PL, NAT., LL; 1.0, 2.0, 3.0, 4.0, 5.0)	DRY UNIT WEIGHT - PCF.	
1	LEAN CLAY: fine sand, silty, dark brown (CL-OL)					moist
2						
3						
4		SS		(16)	117	
5						
6	CLAYEY/SILTY SAND: fine sand, light brown (SC-SM)					moist
7		B		(15)		
8						
9	SILTY SAND: fine sand, clayey, slightly micaceous, several pea sized brown clay pebbles, light brown (SM-SC)	SS		(12)	134	
10						
11						
12						
13	SAND: fine sand, silty, micaceous, light brown (SW)					
14		SS		(12)	105	moist
15	SANDY CLAY: fine sand, slightly micaceous, light brown (CL)	B		(18)		moist to wet
16						
17						
18						
19		SS		(27)		wet
20						

K.O. & A. FORM - 10

BORING NO. 1
PLATE NO. 31

PROJECT 7298

LOG OF BORING 1

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1,0 2,0 3,0 4,0 5,0	DRY UNIT WEIGHT-PCF.	
20							
21	SANDY CLAY: fine sand, micaceous, light brown (CL)						
22							
23							
24		SS			●(35)	79	-wet (?)
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.D.S.A. FORM - 16A

BORING NO. 1

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 2

SHEET 1 OF 1

PROJECT CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION ~~+37.9'~~	DATE OF BORING STARTED 8-14-72 COMPLETED 8-14-72	
TYPE & DESIGNATION OF DRILL 18" Bucket Auger	SAMPLES Disturbed/ Undisturbed	HAMMER 140 lbs falling 30"	DEPTH TO WATER None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	CLAYEY SAND/SANDY CLAY: heavily ~~oil-saturated~~, brown to ~~black, very viscous~~, sticky, odorous (SC-CL-OL)						moist
2							
3							
4		SS			●(14)	123	
5							Note: bucket sunk without pressure
6							
7							
8							~~hole caved~~ due to viscous tar matrix
9							
10							
11							
12							
13	Refusal on old concrete slab ± 4'x5'x6"						
	TOTAL DEPTH 13.0'						
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 18

BORING NO. 2
PLATE NO. 32

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 3

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 40.2'	DATE OF BORING STARTED: 8-14-72 COMPLETED: 8-14-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL) 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT - PCF.	
1	CLAYEY SAND: fine sand, dark brown (SC)						dry
2	SANDY CLAY: fine sand, slightly micaceous, dark brown (CL)	B					moist
3							
4		SS			(19)	111	moist to wet
5							
6	SANDY CLAY/SANDY SILT: fine sand, micaceous, slightly lighter in weight, light tan to brown (CL-ML)						
7							
8							moist
9	SILTY SAND: fine to medium sand, micaceous, light tan to brown (SM)	SPT	13 15		(13)		
10							
11							
12							
13							
14		SS			(21)	115	moist to wet
15	SILTY SAND: fine sand, micaceous, clayey, light tan to brown (SM-SC)						
16							
17							
18							
19		SPT	6 9		(12)		moist
20			10				

K.O. & A. FORM - 16

BORING NO. 3
PLATE NO. 33

PROJECT 7298

LOG OF BORING 3

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL) 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY SAND: (continued) (SM-SC)						
22							
23							
24		SS					-moist
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.D.S.A. FORM - 16A

BORING NO. 3

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 4

SHEET 1 OF _

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 33.5'	DATE OF BORING: STARTED 8-14-72; COMPLETED 8-14-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
0	LEAN CLAY: fine sand, organic, silty, dark brown & black (CL-OL)						moist
2	SANDY CLAY/CLAYEY SAND: fine sand, silty, light brown (CL-SC)						
4		SS			●(16)	92	moist
5	SILTY SAND: fine sand, clayey, slightly micaceous, light brown (SM-SC)						
9							moist
10		SPT	3 6 8		●(16)		
12		B			●(25)		
14		SS			●(12)	116	moist
19		SPT	5 10 9		●(9)		moist
20							

K.O. & A. FORM - 16

BORING NO. 4
PLATE NO. 34

PROJECT 7298

LOG OF BORING 4

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
20							
21	SAND: fine to medium sand, slightly silty, micaceous, several friable sand pebbles (dry), trace of greenish clay residue, light brown (SW)	SS					-moist
22							
23							
24							
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.S.A. FORM - 16A

BORING NO. 4

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 5

SHEET 1 OF 3

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	36.7'	STARTED 8-15-72 COMPLETED 8-15-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ — ● NAT. — ■ LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	CLAYEY SAND: fine sand, few small pebbles, silty, organic, dark brown & black (SC-SM)						moist
4	color change to light brown	SS			● (13)	113	moist to wet
6	SILTY SAND: fine sand, slight clay content, light brown, several limonite stained zones (SM)						moist
9		SPT	11 12 16		● (11)		
12							moist to wet
13	SILTY SAND: fine sand, several pea sized friable sand pebbles, micaceous, slight clay content, light brown (SM)	SS			● (17)	121	
18							wet
19	SANDY/SILTY CLAY: fine sand, several friable sand pebbles, micaceous, light brown (CL-ML)	SPT	5 8 14		● (30)		

K.O. & A. FORM - 16

BORING NO. 5
PLATE NO. 35

PROJECT 7298

LOG OF BORING 5

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL) 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
20							
21	SANDY/SILTY CLAY: (continued) (CL-ML)						moist
22							
23							
24							
25							
26							
27							moist to wet
28	SILTY SAND: fine sand, micaceous, odorous, light green (SM)	B			●(19)		
29							dry
30	SAND: silty, fine to medium, micaceous, odorous, greenish tan becoming tan (SW)	SS			●(5)	109	
31							
32							
33	SANDY CLAY: fine sand, micaceous, fine organics, limonite staining, light greenish tan (CL)						
34				6			
35	SILTY SAND: fine sand, micaceous, odorous, fine organic matter, greenish brown (SM)	SPT		8	●(17)		moist
36				11			
37	SANDY SILT: clayey, fine sand, micaceous, limonite stains, odorous, light greenish brown (ML-CL)						
38							
39							
40		SS			●(27)	95	wet
41	SILTY CLAY: fine sand, micaceous, odorous, limonite light greenish brown (CL-ML)						
42							dry
43	SHELL FRAGMENTS: dense, calcareous sandy shell bed, sand with friable shell fragments light tan & brown	B			●(6)		
44							
45		SPT		10 –			refusal

PROJECT 7298

LOG OF BORING 5

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
45							
46	CALCAREOUS SHELL BED: extremely dense, sand, clay, silt matrix, iron-stained, tan (Coquina)						moist
47							
48	SANDY/SILTY CLAY: fine sand, limonite, shell fragments, mottled tan to brown (CL-ML)						
49							
50	SAND: fine, silty, micaceous, brown						moist
	TOTAL DEPTH 50.0'						

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 6

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 36.1'	DATE OF BORING STARTED: 8-15-72 COMPLETED: 8-15-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	GRASS SOD						moist
2	LEAN CLAY: fine to medium sand, organics, silty, dark brown (CL-OL)						
3							
4		SS			● (17)	113	moist to wet
5							
6	CLAYEY SAND: fine to medium sand, silty, color change to brown (SC-SM)						
7							
8							
9		SPT		4			moist to wet
10				6	● (17)		
11				8			
12	SILTY SAND: fine sand, micaceous, slight clay content, light brown (SM)						
13							
14		SS			● (13)	110	moist
15							
16							
17	SANDY CLAY: silty, micaceous, light brown (CL)						
18							
19		SPT		4			
20				5			
				10			

K.O. & A. FORM - 16

BORING NO. 6
PLATE NO. 36

PROJECT 7298

LOG OF BORING 6

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1,0 2,0 3,0 4,0 5,0)	DRY UNIT WEIGHT-PCF.	
20							
21	SANDY CLAY: (continued) numerous sand pebbles, friable, from pea size to 1/2", light brown (CL)						-moist
22							
23							
24	CLAYEY SAND: fine to medium, silty, micaceous, brown (SC-SM)	B			(9)		-moist
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.B.A. FORM - 18A

KEN O'BRIEN & ASSOCIATES

BORING NO. 6

PLATE NO. 36

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 7

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 32.3'	DATE OF BORING STARTED: 8-18-72 COMPLETED: 8-18-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SAND/GRAVEL FILL: loose						-moist
2	CLAYEY SAND: silty, fine to medium sand, dark brown (SC-SM)						
3	color change to brown						
4		SS			● (10)	131	-moist
5	SILTY SAND: fine sand, micaceous, brown, variable clay content (SM-SC)						
6							
7							
8							
9		SPT		6			-moist
10				13	● (13)		
11				17			
12	color change to tan						
13							
14		SS			● (7)		-moist to dry
15	SILTY/CLAYEY SAND: fine sand, limonite, micaceous, tan (SM-SC)						
16							
17							
18							
19	SANDY/CLAYEY SILT: very fine sand, micaceous, limonite-staining, tan	SPT		5	● (24)		-moist to wet
20	(ML-CL)			8			
				8			

K.O. & A. FORM - 16

BORING NO. 7
PLATE NO. 37

PROJECT 7298

LOG OF BORING 7

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SANDY/CLAYEY SILT: very fine sand, micaceous, limonite-staining (ML-CL)						moist to wet
22							
23							
24	numerous dark brown silty clay clods, moist to dry	B					
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 8

SHEET 1 OF 3

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	30.3'	STARTED 8-21-72 COMPLETED 8-21-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	SAND GRAVEL: fill material, reddish brown						-moist
2	SANDY CLAY: silty, dark brown organic matter (black) (CL-OL)	SPT		10			-moist
3				10			
4				14			
5	CLAYEY SAND: silty, fine to medium sand, reddish brown (SC-SM)						
6							
7							
8	SILTY SAND: clayey, fine to medium sand, reddish brown changing to brown, slightly micaceous (SC-SM)	SS			● (10)	127	-moist
9							
10							
11							
12							
13							
14		SPT		6			-moist
15				9	● (12)		
16				12			
17							
18							
19	SAND: silty, light brown, slightly gaseous odor (SW)	SS			● (12)	109	-moist
20	SILTY/CLAYEY SAND: fine, micaceous, brown (SM-SC)						

K.O. & A. FORM-16

BORING NO. 8
PLATE NO. 38

PROJECT 7298

LOG OF BORING 8

SHEET 2 OF 3

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY/CLAYEY SAND: (continued) (SM-SC)						
22							moist
23	SILTY SAND: fine to medium sand, micaceous, slight gas odor, limonite, variable clay & silt content, brown (SM)						
24							
25							
26							
27	SAND: silty, micaceous, fine to medium sand, very odorous (variable in zones) (SW)						
28				6			
29		SPT		14	• (6)		moist to dry
30				18			
31							
32							moist
33	SILTY/CLAYEY SAND: fine to medium sand, micaceous, limonite, brown (SM-SC)						
34		SS			• (16)	113	
35							
36							
37							
38							
39							moist
40	SILTY SAND/SHELL BED: fine sand, micaceous, limonite stains, shell fragments (SM)	B			• (19)		moist to wet
41	SILTY SAND: fine, micaceous, heavy limonite staining, brown (SM)						
42							
43							
44							
45							

PROJECT 7298

LOG OF BORING 8

SHEET 3 OF 3

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
45							
46	SILTY SAND/SANDY SILT: fine to medium sand, micaceous, slightly odorous, heavy limonite staining, vari-colored gray-green-brown (SM-ML)						moist to wet
47		SS			(19)	100	
48							
49							
50							
51							
52							
53							
54							
55	SAND: silty, fine to medium, micaceous, limonite, heavy odor, greenish gray (SW) shell fragments						moist to wet
56							
57							
58	CLAY: silty, odorous, micaceous, limonite staining, fine sand, brown (CL)						dry to moist
59							
60							
	TOTAL DEPTH 60.0'						

K.O.B.A. FORM-16

BORING NO. 8

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 9

SHEET 1 OF 2

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	26.1'	STARTED 8-18-72 COMPLETED 8-18-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL) 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT - PCF.	
	SURFACE GRAVEL: loose						
1	SANDY CLAY: fine sand, dark brown						-moist
2	SANDY CLAY: color change to brown (CL)						
3							
4		SS			● (16)	108	-moist
5							
6							
7	CLAYEY SAND: silty, micaceous, fine grained, brown (SC-SM)						
8							
9	SILTY SAND: fine sand, micaceous, minor clay content, brown (SM)	SPT	6 12 13		● (11)		-moist
10							
11							
12	- - - -						
13	slight gaseous odor						
14		SS			● (11)		-moist
15							
16	SAND: silty, fine to medium, micaceous, light tan (SW) CLAYEY SAND: fine to medium micaceous, limonite, brown (SC)						
17							
18	SANDY SILT: clayey, fine to medium sand, micaceous,						
19	(gas) odorous, greenish brown (ML-CL)	SPT	7 7 10				-moist
20	color change to green						

K.O. & A. FORM - 18

BORING NO. 9
PLATE NO. 30

PROJECT 7298

LOG OF BORING 9

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
20							
21	SANDY SILT: fine to medium sand, micaceous, limonite stains, heavy gas odor, greenish brown (ML-CL)						-moist
22							
23							
24	SILTY SAND: fine to medium sand, clayey, micaceous, limonite, gas odor, greenish brown (SM-SC)						-moist
25							
26	SAND: fine to medium, tan (SW)						
27	TOTAL DEPTH 25.0'						
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.& A. FORM - 16A

BORING NO. 9

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 10

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 31.1'	DATE OF BORING STARTED: 8-18-72 COMPLETED: 8-18-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
	SURFACE GRAVEL: loose						
1	SANDY CLAY: fine, limonite stained, organics, dark						-moist
2	brown (CL-OL)						
	SANDY CLAY: fine sand,			5			
3	limonite staining, color	SPT		10	● (18)		
	change to brown (CL)			15			
4	CLAYEY SAND: silty, fine to						-moist to
5	medium sand, limonite staining, brown (SC-SM)						wet
6							
7							
8							
9		SS			● (19)	103	
10							
11							
12							
13		B			● (17)		
14							
15	change of color to light brown						
16							
17							
18							
	SANDY/CLAYEY SILT: fine			5			
19	sand, odorous (gas), mica-	SPT		8	● (24)		-wet
	ceous, tan (ML-CL)			11			
20							

K.O. & A. FORM - 16

BORING NO. 10
PLATE NO. 40

PROJECT 7298

LOG OF BORING 10

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
20							
21	SANDY/CLAYEY SILT: fine sand, micaceous, odorous, tan (ML-CL)						
22							
23							
24	CLAYEY SAND: silty, micaceous; limonite stained, fine sand, tan, odorous (SC-SM)	SS			(27)	97	-wet
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 11

SHEET 1 OF 2

PROJECT CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION 35.0'	DATE OF BORING STARTED COMPLETED
TYPE & DESIGNATION OF DRILL 18" Bucket Auger	SAMPLES Disturbed/ Undisturbed	HAMMER 140 lbs falling 30"	DEPTH TO WATER None

LOCATION:- Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
	ASPHALT CONCRETE: dense						moist
1	SANDY CLAY: silty, fine to medium sand, organics, scattered friable sand pebbles, dark brown (CL-ML)						
2							
3				4			
4		SPT		4	● (15)		moist
5				4			
6	color change to light brown						
7							
	SILTY SAND: clayey, fine						
8	sand, very fine mica,						
9	light brown (SM-SC)	SS			● (11)	123	moist
10							
11							
12	limonite staining						
13							
14				6			
	SAND: silty, fine to	SPT		7	● (9)		moist
15	medium sand, micaceous, tan			9			
16	(SW)						
	SILTY SAND: fine sand,						
17	micaceous, fine organics,						
18	limonite, several hard (±) 2" inclusions, light						
	tan (SM)						
19		SS			● (18)		moist to wet
20							

K.O. & A. FORM - 16

BORING NO. 11
PLATE NO. 41

PROJECT 7298

LOG OF BORING 11

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY SAND: (continued) (SM)						-moist to wet
22							
23							
24		B			●(18)		
25							
	TOTAL DEPTH 25.0'						
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 12

SHEET 1 OF 2

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	37.0'	STARTED 8-16-72 COMPLETED 8-16-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL)	DRY UNIT WEIGHT-PCF.	
1	ASPHALT CONCRETE: dense						-moist
2	CLAYEY SAND: silty, fine sand, reddish brown, micaceous (SC-SM)						
3							
4		SS			● (17)		-moist
5							
6	varies in silt and clay content						
7							
8							
9				8			
10		SPT		8 7	● (11)		-moist
11							
12							
13							-wet
14		SS			● (30)	92	
15							
16							
17							
18	SILTY/CLAYEY SAND: limonite (SM-SC)			4			
19		SPT		6	● (32)		
20				9			

K.O. & A. FORM - 15

BORING NO. 12
PLATE NO. 42

PROJECT 7298

LOG OF BORING 12

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY/CLAYEY SAND: (continued) (SM-SC)						wet
22							
23							
24							
25	SILTY SAND: fine green (SM)						wet
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 13

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION: 42.4'	DATE OF BORING STARTED: 8-16-72 COMPLETED: 8-16-72	
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	SANDY CLAY: fine sand, few sand pebbles (friable), dark brown, minor organic (black) (CL-OL)						-moist
2							
3							
4		SPT		2 5 6	● (20)		-moist to wet
5	----						
6	color change to light brown with mica (CL)						
7							
8							
9		SS			● (16)	121	-moist
10	SILTY SAND: clayey, fine sand, micaceous, light brown (SM-SC)						
11							
12							
13							
14		SPT		6 6 7	● (14)		-moist
15							
16							
17							
18							
19	SILTY CLAY: fine sand, micaceous, light brown limonite stains (CL)	SS			● (12)	104	
20							

K.O. & A. FORM - 16

BORING NO. 13
PLATE NO. 43

PROJECT 7298

LOG OF BORING 13

SHEET 2 OF 2

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1,0 2,0 3,0 4,0 5,0)	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY CLAY: (continued) (CL)						-moist
22							
23							
24							
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.&A. FORM - 16A

BORING NO. 13

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 14

SHEET 1 OF 2

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	42.4'	STARTED 8-16-72 COMPLETED 8-16-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1,0 2,0 3,0 4,0 5,0)	DRY UNIT WEIGHT - PCF.	
1	SAND/CLAY/SILT: fill material--concrete, rubble, etc. (CL-ML)						-dry
2							-moist
3	CLAYEY SAND: fine to medium sand, silty, dark brown, black organics (SC-SM)						
4		SS			● (16)	118	-moist
5	color change to brown with mica						
6							
7							
8							
9	CLAYEY SAND: silty, micaceous, fine to medium sand, very dense, limonite, brown (SC-SM)	SPT		6 12 27	● (18)		-moist to wet
10							
11							
12							
13	SAND: slight silt content, fine grained, micaceous, limonite stained, brown (SW)						
14		SS			● (9)	123	-moist
15							
16							
17							
18	SAND: silty, clayey, micaceous, limonite, brown (SW)						
19				12			-moist
20		SPT		16 18	● (14)		

K.O. & A. FORM - 18

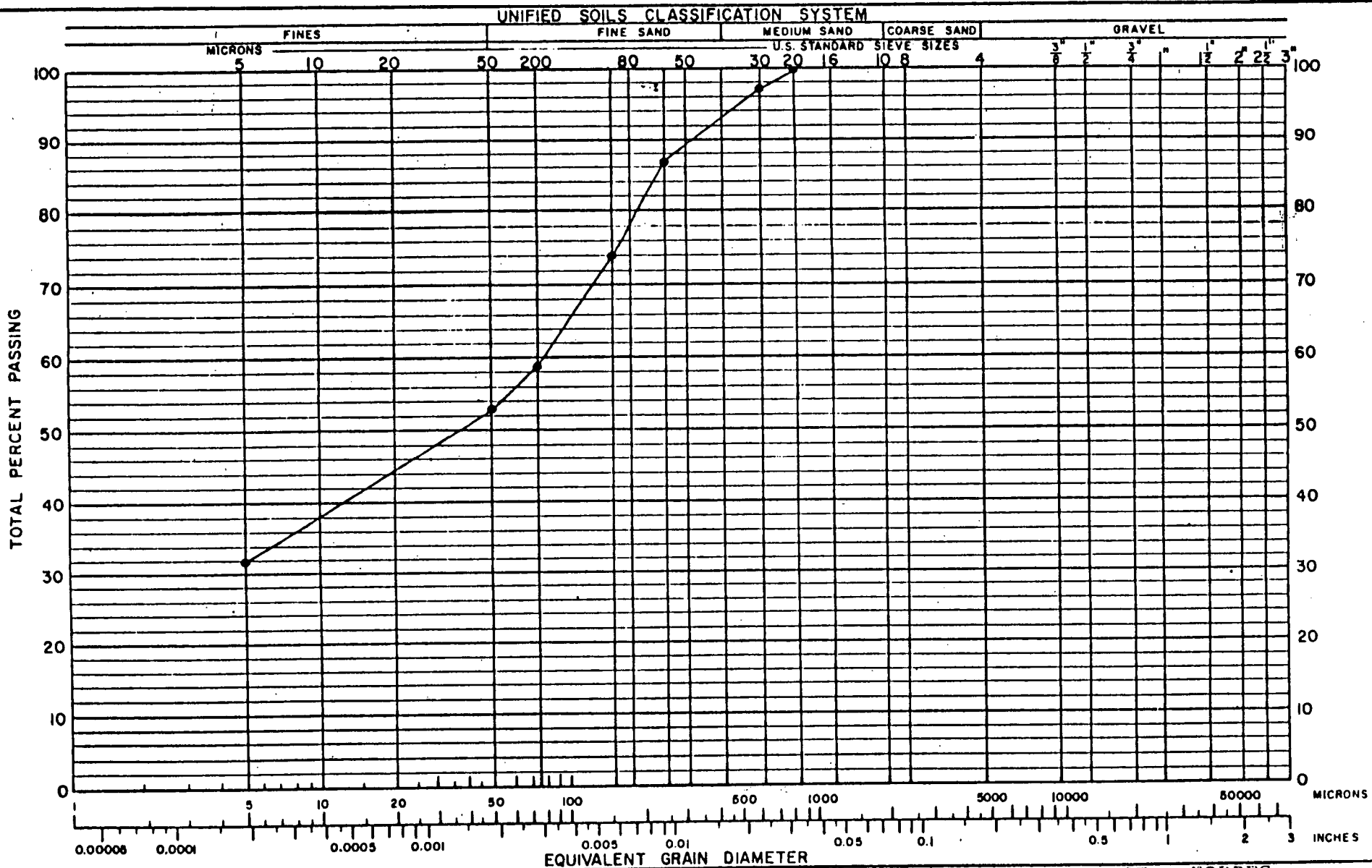
BORING NO. 14

PROJECT 7298

LOG OF BORING 14

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1,0 2,0 3,0 4,0 5,0	DRY UNIT WEIGHT-PCF.	
20							
21	SAND: (continued) (SW)						moist
22							
23							
24							
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							



Sample Boring No. 1 Depth: 3.5'

% Sand	47
% Silt	21
% Clay	32
LEAN CLAY (CL-OL)	

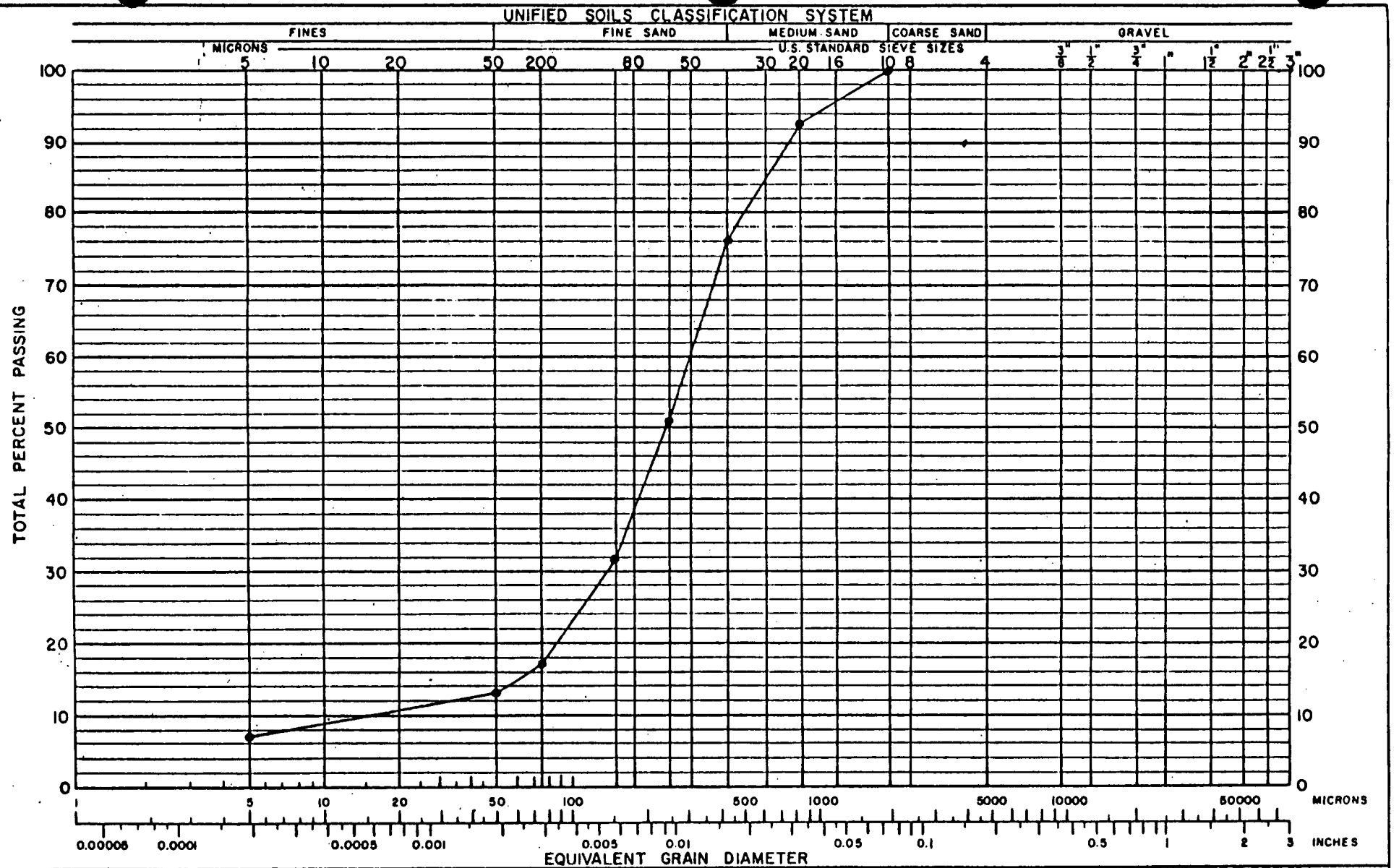
Liquid Limit	37
Plastic Limit	17
Plasticity Index	20

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 9

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS



Sample Boring No. 4 Depth: 23.5'

% Sand 87
% Silt 6
% Clay 7
SAND (SW)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 10

KEN O'BRIEN & ASSOCIATES
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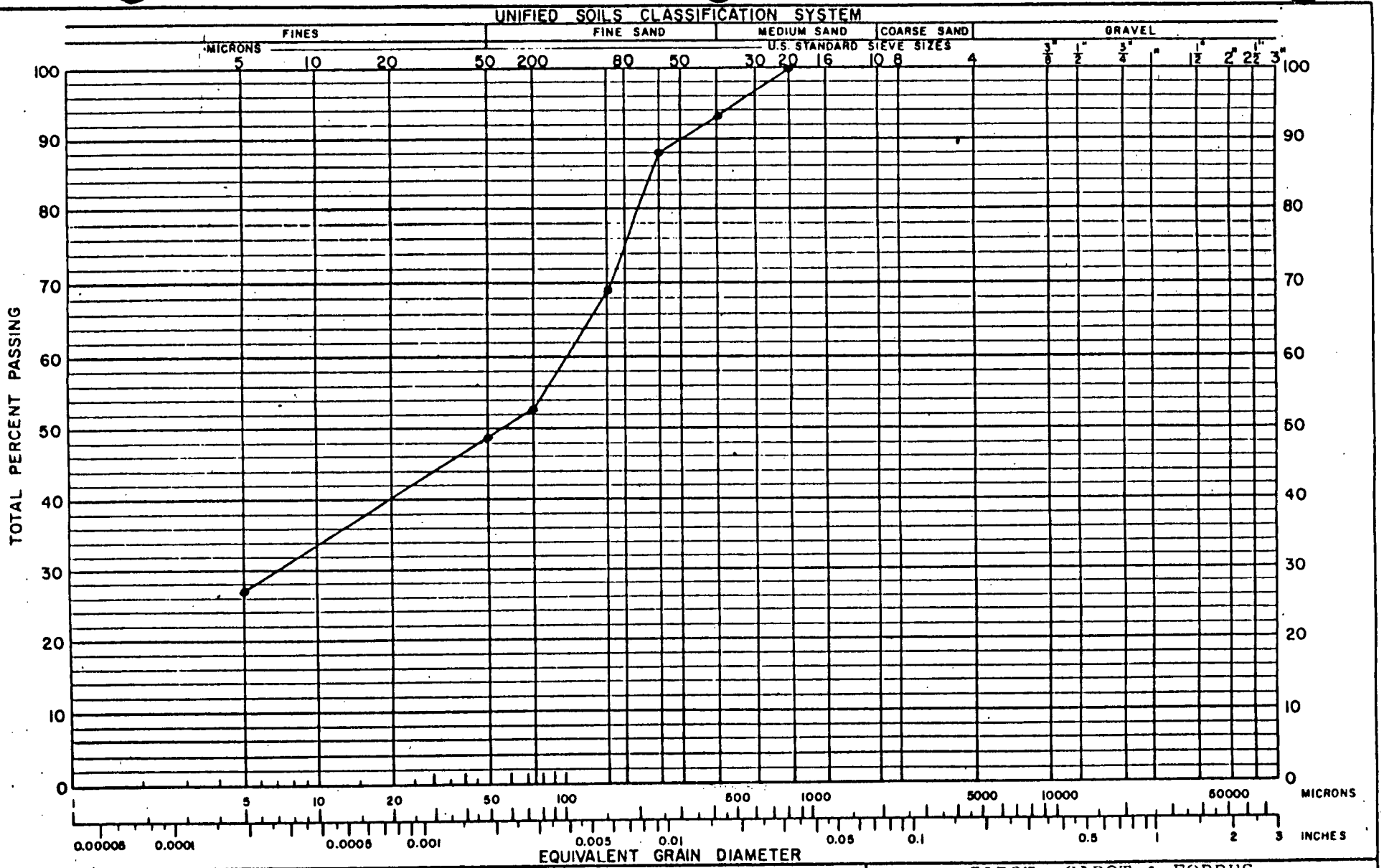
K.O.B.A. FORM-6



Sample Boring No. 5 Depth: 3.5'

% Sand	51	Liquid Limit	35
% Silt	22	Plastic Limit	17
% Clay	27	Plasticity Index	18

CLAYEY SAND (SC-SM)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 11

KEN O'BRIEN & ASSOCIATES
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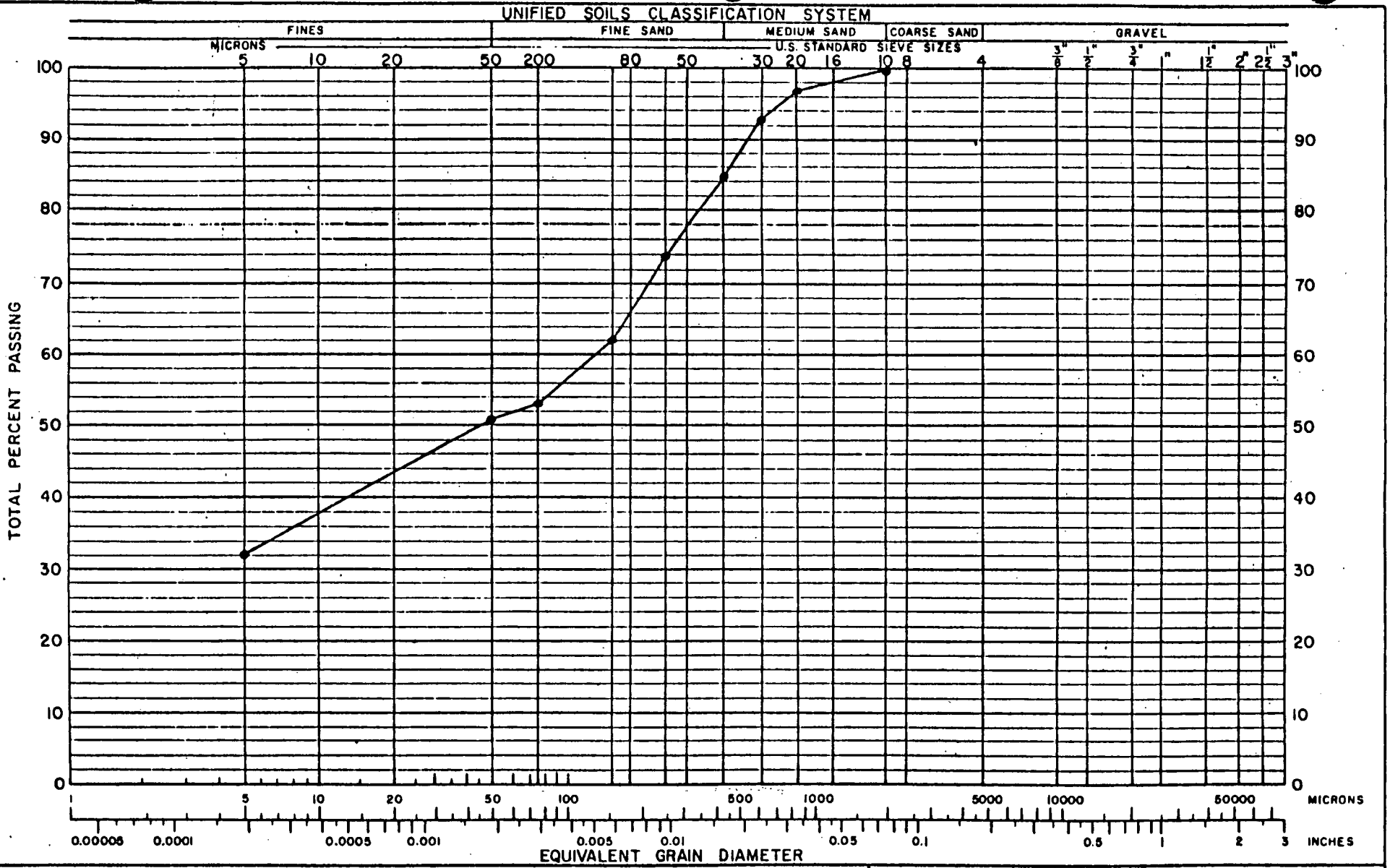

Sample Boring No. 6 Depth: 3.5'

% Sand	49	Liquid Limit	36
% Silt	19	Plastic Limit	16
% Clay	32	Plasticity Index	20

LEAN CLAY (CL-OL)

CABOT, CABOT & FORBES
C.C.&F. WESTERN DEVELOPMENT CO., INC.
SHELL CHEMICAL PLANT PROPERTY

GRADING ANALYSIS

PROJECT NO. 7298 DATE 9-11-72 PLATE NO. 12

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

FORM-6

Vol. II of III

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 15

SHEET 1 OF 3

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	36.7'	STARTED 8-17-72 COMPLETED 8-17-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SURFACE GRAVEL: loose						
1	SANDY CLAY: silty, fine sand, small friable pebbles, reddish brown (CL-ML)						-moist to dry
2							-moist
3		SS			●(14)	133	
4	CLAYEY SAND: silty, fine to medium sand, few pea sized clay pebbles, reddish brown (SC-SM)						
5							
6							
7							
8	limonite stains & micaceous						
9		SS			●(13)	117	-moist
10							
11							
12							
13							
14	color change to brown	SPT		6 5 9	●(20)		-moist to wet
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 16

BORING NO. 15

PROJECT 7298

LOG OF BORING 15

SHEET 2 OF 3

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL, NAT., LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	CLAYEY SAND: fine sand, silty, micaceous, limonite stains (SC-SM)						wet
				7			
22		SPT		12	• (27)		
	fine white lime(?)			14			
23	inclusions						
24							
25		B			• (13)		moist
26	SILTY SAND: fine, micaceous, minor clay, brown						
27	(SM)						
28							
29	SAND: fine sand, clean, micaceous, tan, several pea sized clay lumps (SW)	SS			• (5)	117	moist to dry
30							
31							
32							
33							
				8			
34		SPT		14	• (8)		moist
	SILTY/CLAYEY SAND: (SM-SC)			12			
35	SAND/SILT/CLAY: mixed, micaceous, limonite stained						
36	clay lumps (±) pea sized, mottled tan & brown						
37	(SM-SC)						
38							moist
	SILTY/CLAYEY SAND: fine,						
39	micaceous, limonite stained, brown, clay lumps	B					
40	to 1" (SM-SC)						moist to
41		SS			• (21)	96	wet
42							
43							
44	SILTY/SANDY CLAY: calcareous, limonite, micaceous,						
45	numerous shell fragments, greenish tan (CL-ML)						

K.D.& A. FORM - 18A

BORING NO. 15

PROJECT 7298

LOG OF BORING 15

SHEET 3 OF 3

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL NAT. LL 1.0 2.0 3.0 4.0 5.0	DRY UNIT WEIGHT-PCF.	
45							
46	SILTY/SANDY CLAY: (continued) (CL-ML)						-moist
47	CLAY: calcareous, numerous shell fragments, limonite, greenish tan (CL)	B			• (15)		
48							
49	COQUINA: numerous fragments dense, well cemented, brown						
50	to tan						
51	SILTY SAND: fine, micaceous, reddish brown (SM)						
	TOTAL DEPTH 51.0'						

K.O.B.A. FORM - 16

BORING NO. 15

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 16

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 36.0'	DATE OF BORING STARTED: 8-17-72 COMPLETED: 8-17-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	GRASS: sod-roots						-moist
2	SANDY CLAY: fine sand, silty, organics (roots), dark brown (CL-OL)						
3							
4							
5	SANDY CLAY: fine sand, silty, variable sand content, micaceous, reddish brown (CL)	SS			● (17)	118	-moist
6		B			● (18)		-moist to wet
7							
8							
9		SPT		5 4 6	● (16)		-moist
10							
11							
12							
13							
14							
15	SILTY/CLAYEY SAND: fine to medium, several clay lumps, micaceous, reddish brown (SM-SC)						-moist
16							
17							
18							
19	SILTY SAND: fine to medium sand, micaceous, limonite, light brown (SM)	SS			● (11)	113	-moist
20							

K.O. & A. FORM - 16

BORING NO. 16
PLATE NO. 46

PROJECT 7298

LOG OF BORING 16

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY SAND: (continued) (SM)						
22							
23	scattered clay lumps, greater clay content (SM-SC)	B			● (19)		-moist to wet
24							
25	TOTAL DEPTH 25.0'						
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 17

SHEET 1 OF 2

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	37.5'	STARTED 8-17-72 COMPLETED 8-17-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
	SURFACE GRAVEL: loose						
1	SAND: silty, clayey, dark brown (SW)						-moist
2							
3							
	SANDY CLAY: silty, red (CL)	SS			● (16)	119	-moist
4							
5							
	SILTY SAND: slight clay content, fine sand, several small clay lumps (±) 1/2",						
6							
7	reddish brown (SM)						
8							
				5			
9		SPT		8	● (15)		-moist
				5			
10		B			● (14)		
	increased clay content						
11	(SM-SC)						
12							
13							
14		SS			● (13)	123	-moist
15							
16							
17							
18							
	SILTY SAND: fine to medium			8			
19	sand, micaceous, limonite	SPT		13	● (10)		-moist
	stains, light brown (SM)			15			
20							

K.O. & A. FORM - 16

BORING NO. 17
PLATE NO. 47

PROJECT 7298

LOG OF BORING 17

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL ▲ NAT. ● LL ■ (1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY SAND: fine to medium sand, variable clay content, micaceous, light brown, several 2" sized brown clay inclusions (SM)						-moist
22							
23							
24							
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.& A. FORM - 16A

BORING NO. 17

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 18

SHEET 1 OF 2

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	37.7'	STARTED 8-18-72 COMPLETED 8-18-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1,0 2,0 3,0 4,0 8,0)	DRY UNIT WEIGHT-PCF.	
	SURFACE GRAVEL: loose						-dry
1	SILTY SAND: fine sand, hard, dark brown clay clods (broken fragments), micaceous, red (SM-SC)						-dry to moist
2							
3	gradational color change to brown						-moist
4		SS			● (13)	116	
5							
6							
7							
8				10			
9		SPT		10	● (13)		-moist
10				15			
11	SAND: fine to medium sand, micaceous, numerous silty clay lumps, brown (SP)						
12							
13							
14		B			● (7)		-moist to dry
15							
16							
17							
18	color change to light brown						
19		SS			● (14)	116	-moist
20							

E.O. & A. FORM - 16

BORING NO. 18
PLATE NO. 48

PROJECT 7298

LOG OF BORING 18

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SAND: (continued) (SP)						-moist
22							
23	(homogeneous)						
24							
25		B			● (11)		
	TOTAL DEPTH 25.0'						
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.B.A. FORM - 18A

BORING NO. 18

PLATE NO. 48

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 19

SHEET 1 OF _

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 39.9'	DATE OF BORING STARTED: 8-18-72 COMPLETED: 8-18-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SILTY SAND: fine sand, clayey, dark brown (SM-SC)						moist to dry
2							
3	SANDY CLAY: silty, fine sand, limonite staining, reddish brown (CL-ML)						moist
4	SILTY SAND: clayey, fine sand, numerous silty clay lumps, limonite stained, brown (SM-SC)	SS			● (11)	122	
5							
6	Note: silt & clay content variable						
7	CLAYEY SAND: silty, fine sand, micaceous, brown (SC-SM)						
8				5			
9		SPT		10	● (17)		moist
10				13			
11	SILTY SAND: clayey, micaceous, fine sand, brown (SM-SC)						
12							
13							
14							moist
15							
16							
17	color change to light brown & limonite staining						
18							
19		SPT		7 11 13	● (17)		
20							

K.O. & A. FORM - 16

BORING NO. 19
PLATE NO. 49

PROJECT 7298

LOG OF BORING 19

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
	SILTY SAND: (continued)						moist
21	(SM-SC)						
22							
23							
24							
25							
	TOTAL DEPTH 25.0'						
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 20

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 32.5'	DATE OF BORING STARTED: 8-21-72 COMPLETED: 8-21-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ — ● NAT. — ■ LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SAND/GRAVEL: loose SILTY/SANDY CLAY: fine sand, fill material, soft, dark brown (CL-ML)						moist
5							moist
6	CLAYEY SAND: silty, fine to medium sand, brown (SC-SM)	SS			● (16)	111	
8	SILTY SAND: clayey, fine sand, brown (SM-SC)						moist
14	SILTY SAND: fine sand, micaceous, brown, clayey (SM-SC)	SPT		5 8 8	● (13)		moist

K.O. & A. FORM - 16

BORING NO. 20
PLATE NO. 50

PROJECT 7298

LOG OF BORING 20

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1,0 2,0 3,0 4,0 5,0)	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY SAND: clayey, micaceous, fine grained, limonite stained, brown (SM-SC)						
22							
23							wet
24		SS			●(37)	97	
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.& A. FORM - 16A

BORING NO. 20

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 21

SHEET 1 OF 2

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 32.5'	DATE OF BORING: STARTED 8-21-72; COMPLETED 8-21-72
TYPE & DESIGNATION OF DRILL: 18" Bucket Auger	SAMPLES: Disturbed/ Undisturbed	HAMMER: 140 lbs falling 30"	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	DRY UNIT WEIGHT-PCF.	
1	SAND/GRAVEL: loose					-moist
2	SANDY CLAY: silty, dark brown (CL-ML)					
3						
4						
5						-moist
6						
7	color change to reddish brown, scattered pebbles to 1/8"	SS		(13)		
8						
9						
10						
11						
12						
13						-moist
14	SILTY SAND: clayey, micaceous, fine sand, color change to brown (SM-SC)					
15						
16						
17						
18	SAND: silty, scattered clay inclusions, micaceous, brown (SW-SP)	SS		(7)		-moist to dry
19						
20						

MOISTURE CONTENT %: PL ▲ NAT. ● LL ■ (1.0, 2.0, 3.0, 4.0, 5.0)

K.O. & A. FORM - 16

BORING NO. 21
PLATE NO. 51

PROJECT 7298

LOG OF BORING 21

SHEET 2 OF 2 .

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SAND: silty, scattered clay inclusions, fine sand, micaceous, brown (SW-SP)						-moist
22							
23							
24							
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.D.S.A. FORM - 16A

BORING NO. 21

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 22

SHEET 1 OF 2

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	31.6'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
18" Bucket Auger	Disturbed/ Undisturbed	140 lbs falling 30"	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
	SAND/GRAVEL: loose						-moist
1	CLAYEY SAND: silty, organics, fine sand, dark brown (SC-SM)						
2							
3							
4							
5	color change to reddish brown	SS			●(14)	116	-moist
6							
7							
8							
9							
10							
11							
12	SILTY SAND: fine sand, brown, slightly clayey (SM)						-moist
13							
14		SS			●(11)		
15							
16							
17							-moist
18	SILTY/CLAYEY SAND: fine sand, micaceous, scattered hard clay inclusions, brown (SM-SC)						
19							
20							

K.O. & A. FORM - 16

BORING NO. 22
PLATE NO. 52

PROJECT 7298

LOG OF BORING 22

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	SILTY/CLAYEY SAND: (continued)						-moist
22	SANDY/SILTY CLAY: fine sand, micaceous, brown (CL-ML)						
23							
24		SS			●(26)	93	
25							
26	TOTAL DEPTH 25.0'						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.& A. FORM - 16A

BORING NO. 22

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING IX

SHEET 1 OF 1

PROJECT CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION 33.7'	DATE OF BORING STARTED 8-22-72 COMPLETED 8-22-72
TYPE & DESIGNATION OF DRILL 24" Bucket Auger	SAMPLES None	HAMMER None	DEPTH TO WATER None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	SANDY CLAY: fine sand, silty, dark brown (CL-OL)						-moist
2							
3							-moist
4	SANDY CLAY: fine sand, silty, reddish brown (CL)						
	TOTAL DEPTH 4.0'						
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 16

BORING NO. 1X
PLATE NO. 53

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1A

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION: 34.4'	DATE OF BORING: STARTED 8-22-72; COMPLETED 8-22-72	
TYPE & DESIGNATION OF DRILL: 24" Bucket Auger	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL, NAT., LL; 1.0, 2.0, 3.0, 4.0, 5.0)	DRY UNIT WEIGHT - PCF.	
1	SANDY CLAY: silty, fine sand, dark brown (CL-OL)						-moist
4	OIL-SATURATED CLAY: fine sand, silty, dark brown to black (OL)						-moist
6	SANDY CLAY: silty, fine sand, reddish brown (CL)						
	TOTAL DEPTH 6.0'						

K.O. & A. FORM - 16

BORING NO. 1A
PLATE NO. 54

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1B

SHEET 1 OF 1

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	34.7'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
24" Bucket Auger	None	None	None

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
	LOCATION: Refer to Plate No.						
1–5	OIL-SATURATED CLAY: fine sand, silt, heavily oil saturated, odorous, dark brown, organic (CL-OL)						moist
5–10	SANDY CLAY: fine sand, silty, reddish brown (CL)						moist
10	TOTAL DEPTH 10.0'						
11–20							

K.O. & A. FORM - 16

BORING NO. 1B
PLATE NO. 55

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1C

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 35.1'	DATE OF BORING STARTED: 8-22-72 COMPLETED: 8-22-72
TYPE & DESIGNATION OF DRILL: 24" Bucket Auger	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1–2	SANDY CLAY: fine sand, silty, dark brown (CL-OL)						-moist
3–5	OIL-SATURATED CLAY: fine sand, silty, odorous, brown to black (OL)						
5–6	SANDY CLAY: silty, fine sand, reddish brown (CL)						-moist
6	TOTAL DEPTH 6.0'						

K.O. & A. FORM - 16

BORING NO. 1C
PLATE NO. 56

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1D

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO.,INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 35.0'	DATE OF BORING: STARTED 8-22-72; COMPLETED 8-22-72
TYPE & DESIGNATION OF DRILL: 24" Bucket Auger	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SANDY CLAY: silty, fine sand, light to dark brown (CL)						-dry to moist
2	OIL-SATURATED CLAY: silty, fine sand, heavy oil saturation, odorous, brown to black (OL)						
3							
4							
5							
6	SANDY CLAY: silty, fine sand, reddish brown (CL)						
	TOTAL DEPTH 6.0'						
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 18

BORING NO. 1D
PLATE NO. 57

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1E

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 35.2'	DATE OF BORING STARTED: 8-22-72 COMPLETED: 8-22-72
TYPE & DESIGNATION OF DRILL: 24" Bucket Auger	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
	LOCATION: Refer to Plate No.						
1	SANDY CLAY: silty, fine sand, light to dark brown (CL)						moist
2	OIL-SATURATED CLAY: silty, fine sand, heavily oil saturated, odorous, dark brown to black (OL)						
3							
4							
5							
6							moist
7	SANDY CLAY: silty, fine sand, reddish brown (CL)						
	TOTAL DEPTH 7.0'						
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 16

BORING NO. 1E
PLATE NO. 58

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1F

SHEET 1 OF 1

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	35.5'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
24" Bucket Auger	None	None	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	SANDY/SILTY CLAY: (CL-ML)						-dry
2	OIL-SATURATED CLAY: silty, odorous, brown to black (OL)						-moist -moist
3							
4							
5	SILTY SAND: clayey, fine sand, greenish brown (SM)						-moist
6							
7	TOTAL DEPTH 6.0'						
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 18

BORING NO. 1F
PLATE NO. 59

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1G

SHEET 1 OF 1

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	35.8'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
24" Bucket Auger	None	None	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ — ● NAT. — ■ LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SANDY CLAY: silty, fine sand, light to dark brown (CL)						-moist
5	OIL-SATURATED CLAY: silty, fine sand, extreme oil saturation, odorous, black (OL)						-wet
7	SANDY CLAY: silty, fine sand, reddish brown (CL)						-moist
8	TOTAL DEPTH 8.0'						

E.O. & A. FORM - 18

BORING NO. 1G
PLATE NO. 60

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 1H

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 36.2'	DATE OF BORING STARTED: 8-22-72 COMPLETED: 8-22-72
TYPE & DESIGNATION OF DRILL: 24" Bucket Auger	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL, NAT., LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SANDY CLAY: silty, fine sand, light to dark brown (CL)						-moist to wet
2	OIL-SATURATED CLAY: silty, fine sand, heavily oil saturated, extremely odorous, dark brown to black (OL)						
3							
4							
5							-moist
6	SANDY CLAY: silty, fine sand, reddish brown (CL)						
7							
8	TOTAL DEPTH 7.0'						
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 16

BORING NO. 1H
PLATE NO. 61

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 11

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 36.3'	DATE OF BORING STARTED: 8-22-72 COMPLETED: 8-22-72
TYPE & DESIGNATION OF DRILL: 24" Bucket Auger	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL, NAT., LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.
1–2	SANDY CLAY: silty, fine sand, light to dark brown (CL)					
3–6	OIL-SATURATED CLAY: silty, fine sand, extreme heavy oil saturation, black (OL)					
7–8	SILTY SAND: slight clay content, fine sand, slight odor, greenish brown (SM)					
9–20	TOTAL DEPTH 8.0'					

E.O. & A. FORM - 16

BORING NO. 11
PLATE NO. 62

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 2A

SHEET 1 OF 1

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	37.9'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
24" Bucket Auger	None	None	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1,0 2,0 3,0 4,0 5,0)	DRY UNIT WEIGHT - PCF.	
1	SANDY CLAY: dark brown (CL)						-dry -moist
2	OIL-SATURATED CLAY: extremely odorous, oil-saturated clay, silty, very little fine sand, black, viscous tar & oil (OL)						
3							
4							
5							
6							collapsed
7							
8							
9							
10							
11							
12							
13	(hole collapsed due to soft tar & oil)						
14	TOTAL DEPTH 13.0'						
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 10

BORING NO. 2A
PLATE NO. 63

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 2B

SHEET 1 OF 1

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	37.7'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
24" Bucket Auger	None	None	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL, NAT., LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1–4	SANDY CLAY: fine sand, light to dark brown (CL)						-moist
5–7	OIL-SATURATED CLAY: silty, heavy oil/tar saturation, very odorous, dark brown to black (OL) refusal due to concrete slab fragment						
8	TOTAL DEPTH 7.5'						
9–20							

K.O. & A. FORM - 16

BORING NO. 2B
PLATE NO. 64

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 2C

SHEET 1 OF 2

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	37.8'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
24" Bucket Auger	None	None	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	SANDY CLAY: silty, fine sand, scattered pebbles to cobbles, dark brown (CL-OL)						-moist
8	OIL-SATURATED CLAY: mixed oil & tar, organics, odorous, soft, black (OL)						-moist to wet

K.O. & A. FORM - 18

BORING NO. 2C
PLATE NO. 65

PROJECT 7298

LOG OF BORING 2C

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL ▲ NAT. ■ LL 1,0 2,0 3,0 4,0 5,0	DRY UNIT WEIGHT-PCF.	
20							
21	OIL-TAR SATURATED: (continued) (OL)						-soft
22							
23	hole collapsed @ 23.0'						
	TOTAL DEPTH 23.0'						
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 2D

SHEET 1 OF 2

PROJECT CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION 37.6'	DATE OF BORING STARTED 8-22-72 COMPLETED 8-22-72
TYPE & DESIGNATION OF DRILL 24" Bucket Auger	SAMPLES None	HAMMER None	DEPTH TO WATER None

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
	LOCATION: Refer to Plate No.						
1	SANDY CLAY: silty, fine sand, few pebbles, dark brown (CL-OL)						moist
2							
3	OIL-SATURATED CLAY: silty, fine sand, scattered pebbles & cobbles to 3", odorous, heavy oil saturation, dark brown to black (OL)						
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 18

BORING NO. 2D
PLATE NO. 66

PROJECT 7298

LOG OF BORING 2D

SHEET 2 OF 2

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % PL ▲ NAT. ● LL ■ (1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
20							
21	OIL-SATURATED CLAY: (continued)						-moist
22	SANDY CLAY: silty, fine sand, pebbles to 3/8", light brown (CL)						
23							
24							
25							
26							
27							
28							
29							
30							
31	TOTAL DEPTH 30.0'						
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							

K.O.S A. FORM - 16A

BORING NO. 2D

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 2E

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: 39.3'	DATE OF BORING STARTED: 8-22-72 COMPLETED: 8-22-72
TYPE & DESIGNATION OF DRILL: 24" Bucket Auger	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL, NAT., LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	SANDY CLAY: silty, fine sand, angular pebbles & gravel to 1", light to dark brown (CL)						moist
2							
3							
4							
5	SANDY CLAY: silty, fine sand, color change to brown (CL)						moist
6	SILTY SAND: clayey, fine to medium sand, scattered hard clay inclusions, greenish brown (SM)						moist
7							
8							
9							
10							
11	TOTAL DEPTH 10.0'						
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 16

BORING NO. 2E
PLATE NO. 67

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BORING 2F

SHEET 1 OF 1

PROJECT	SURFACE ELEVATION	DATE OF BORING
CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	39.7'	STARTED 8-22-72 COMPLETED 8-22-72

TYPE & DESIGNATION OF DRILL	SAMPLES	HAMMER	DEPTH TO WATER
24" Bucket Auger	None	None	None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE	CLASSIFICATION OF MATERIALS (in feet)	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SANDY CLAY: silty, fine to medium sand, scattered gravel to 1-1/2", reddish brown (CL)						-dry to moist
2							-moist
3	SANDY CLAY: silty, fine to medium sand, dark brown (CL)						
4							
5	color change to brown						
6							
7							
8							-moist
9	SILTY SAND: clayey, fine sand, micaceous, limonite stained, brown (SM)						
10							
11	TOTAL DEPTH 10.0'						
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 16

BORING NO. 2F
PLATE NO. 68

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BACKHOE 2(Retest)

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION: --	DATE OF BORING STARTED: 8-28-72 COMPLETED: 8-28-72	
TYPE & DESIGNATION OF DRILL: 24" Backhoe Bucket	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	CLAYEY SAND/SANDY CLAY: heavily oil-saturated, brown to black, very viscous, sticky, odorous (SC-CL-OL)						-moist
2							
3							
4							
5							hole caved to 15'x15'
6							
7							
8							
9							
10							
11							
12							
13	----						
14	concrete, clay pipe, wood, steel, etc. (old dump) concrete slab ± 4'x5'x6"						
15							
	TOTAL DEPTH 15.0'						
16							
17							
18							
19							
20							

K.O. & A. FORM - 16

BORING NO. 2(Retest)
PLATE NO. 69

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BACKHOE 23

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY		SURFACE ELEVATION: --	DATE OF BORING STARTED 8-25-72 COMPLETED 8-25-72
TYPE & DESIGNATION OF DRILL: 24" Backhoe Bucket	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.
LOCATION: Refer to Plate No.						
1–5	OIL-SATURATED CLAY: fine to medium sand, silty, heavy oil saturation, organic, extremely odorous, dark brown (OL)					
6–10	CHEMICALLY-SATURATED CLAYEY/SILTY SAND: fine to medium sand, odorous, light greenish brown (SC-SM-OL)					
11–20	TOTAL DEPTH 10.0'					

K.O. & A. FORM - 16

BORING NO. 23
PLATE NO. 70

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BACKHOE 24

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION: --	DATE OF BORING STARTED: 8-25-72 COMPLETED: 8-25-72	
TYPE & DESIGNATION OF DRILL: 24" Backhoe Bucket	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SILTY SAND: fine to medium, tan (SM)						-moist
2	SANDY CLAY: slightly odorous, dark brown (CL-OL)						
3	SANDY CLAY: fine sand, brown (CL)						
4							
5							-moist
6	CLAYEY/SILTY SAND: fine to medium, brown (SC-SM)						
7							
8							
9	TOTAL DEPTH 8.0'						
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 18

BORING NO. 24
PLATE NO. 71

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BACKHOE 25

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION: --	DATE OF BORING: STARTED 8-25-72; COMPLETED 8-25-72	
TYPE & DESIGNATION OF DRILL: 24" Backhoe Bucket	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1–6	CLAYEY/SILTY SAND: slight chemical odor, light to dark brown (SC-SM)						moist
7–20	TOTAL DEPTH 6.0'						

K.O. & A. FORM-16

BORING NO. 25
PLATE NO. 72

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BACKHOE 26

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION: --	DATE OF BORING STARTED: 8-25-72 COMPLETED: 8-25-72	
TYPE & DESIGNATION OF DRILL: 24" Backhoe Bucket	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT-PCF.	
1	ASPHALT CONCRETE: dense						-moist
1	SANDY CLAY: fine to medium sand, dark brown (CL)						
2							
3							
4							
5							-moist
6	SANDY CLAY: fine to medium sand, silty, color change to brown (CL)						
7							
8							
9	TOTAL DEPTH 8.0'						
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

K.O. & A. FORM - 18

BORING NO. 26
PLATE NO. 73

KEN O'BRIEN & ASSOCIATES
CONSULTING ENGINEERS

LOG OF BACKHOE 27

SHEET 1 OF 1

PROJECT: CABOT, CABOT & FORBES C.C.&F. WESTERN DEVELOPMENT CO., INC. SHELL CHEMICAL PLANT PROPERTY	SURFACE ELEVATION: --	DATE OF BORING STARTED: 8-25-72 COMPLETED: 8-25-72	
TYPE & DESIGNATION OF DRILL: 24" Backhoe Bucket	SAMPLES: None	HAMMER: None	DEPTH TO WATER: None

LOCATION: Refer to Plate No.

DEPTH FROM SURFACE (in feet)	CLASSIFICATION OF MATERIALS	SYMBOL	SAMPLE INTERVAL	PENETRATION RESISTANCE	MOISTURE CONTENT % (PL ▲ NAT. ● LL ■; 1.0 2.0 3.0 4.0 5.0)	DRY UNIT WEIGHT - PCF.	
1	SILTY SAND: fine to medium sand, tan (SM)						-moist
2	SANDY CLAY: fine to medium sand, slightly organic near upper contact, dark brown (CL)						
3							
4							
5							
6							-moist
7	SANDY CLAY: fine to medium sand, color change to brown (CL)						
8							
9	TOTAL DEPTH 8.0'						
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

E.O. & A. FORM - 16

BORING NO. 27
PLATE NO. 74

PRELIMINARY SITE INVESTIGATION
PROPOSED INDUSTRIAL DEVELOPMENT
SHELL CHEMICAL PROPERTY
TORRANCE, CALIFORNIA
FOR

C. C. & F. WESTERN DEVELOPMENT CO., INC.

WESTERN LABORATORIES

13626 S. NORMANDIE AVE • 213/321-9900 • GARDENA, CALIFORNIA 90249
979 NORTH MAIN STREET • 714/639-9430 • ORANGE, CALIFORNIA 92667

September 27, 1972 Work Order 48[illegible]

F. C. & I. Western
Development Co., Inc.
[illegible] Wilshire Boulevard
Los Angeles, California 90017

Attn: Mr. Ed Record

Re: Preliminary Site Investigation - Proposed Industrial Development - Shell Chemical Property, Torrance, California

Dear Sir:

At your request, a preliminary site investigation was performed at the above reference.

It is proposed to subdivide the parcel into industrial lots and subsequently construct simple story tilt-up concrete structures with floor slabs for the most part at dock height. It is not known at this time whether light industrial or heavy industrial structures will be built.

Grading plans are not available at this time, but it is assumed that the site grading will involve minimal cuts and fills.

The purpose of our investigation was to explore sub-surface conditions and to develop preliminary soil engineering design data to permit proper development of the project.

SITE CONDITIONS

The site extends from 190th Street approximately 4500 ft. south and on both sides of Vermont Avenue, approximately 2000 ft. to the west and approximately 1000 ft. to the east.

Thirty eight (38) exploratory borings were placed at locations as shown on the attached map using a rotary bucket drilling rig. The logs of these borings are shown on the attached Boring Logs and on Table I, to depths as indicated.

Thirty nine (39) exploratory test pits were placed at locations as shown on the attached map using a tractor mounted backhoe modified for soil sampling. The logs of these test pits are shown on Table I.

These borings and test pits were continuously logged by our Engineering Geologist at the site.

Disturbed and undisturbed samples were taken for classification and laboratory testing. Results of the test data are provided in this report.

Ground water was not encountered in the borings.

Fill and unconsolidated natural soils were encountered in several of the borings as indicated in the Boring Logs and Table I.

Oil saturated and contaminated soils were encountered in several of the borings and test pits. These were delineated on the attached map and cross section. This material is indicated on the Boring Logs and on Table I.

Natural ground as encountered in the borings classifies as Clay, sandy, underlain by Sand, clayey, Sand, silty, Silt, sandy and Silt, clayey.

Undisturbed samples for detailed testing in our laboratory were obtained by pushing or driving a sampling spoon into the material. A solid barrel-type spoon was used having an inside diameter of 2.50 inches with a tapered cutting tip at the lower end and a ball valve at the upper end. The barrel is lined with thin brass rings. The spoon penetrated into the soil below the depth of boring approximately 12 inches. The central portion of this sample was retained for testing. All samples in their natural field condition were sealed in airtight containers and transported to the laboratory.

Standard Penetration Tests were performed using a split-spoon sampler with an outside diameter of 2 inches driven by means of a 140 pound weight falling a distance of 30 inches. The results of these tests are indicated on the Boring Logs.

LABORATORY TESTS

A. Moisture content and unit weight determinations were made on a specimen from each undisturbed sample providing information on the relative density and the moisture retention properties and also serving as a further index of classification. Results of these tests are presented on the Boring Logs.

B. Shear tests were made with a direct shear machine of the strain control type in which the rate of strain is 0.05 inch per minute. The machine is so designed that tests may be performed without removing the specimens from the rings in which they were obtained, insuring a minimum of disturbance from the field conditions. Specimens were subjected to shear under normal loads equivalent to the overburden surcharge on the specimens being tested. The results, expressed as shearing resistance in kips per square foot, are those given on Table II.

C. Consolidation tests were performed on in-situ moisture and saturated specimens of typical soils. The consolidometer, like the direct shear machine, is designed to receive the specimens in the field condition. Porous stones, placed at the top and bottom of the specimens permit the free flow of water into or from the specimens furing the test. Successive load increments were applied to the top of the specimen and progressive and final settlements under each increment were recorded to an accuracy of 0.0001 inch. The final settlements so obtained are plotted to determine the curves shown on Plates A through E.

D. Expansion tests were performed on typical specimens of natural soils. This test measures the percent swell of the soils from air-dried to saturated under a surcharge of 60 lbs./sq.ft., after a 24-hour saturation period. - Under the above standard, a percent swell of 3.0 percent or greater is classed as expansive. Results of these tests are presented on Table III and indicate the soils to be non-expansive to moderately expansive under the above standard.

E. Hydrometer method of grain size analysis. This procedure utilizes the relationship among the velocity of fall of spheres in a fluid, the diameter of the sphere, the unit weights of the sphere and of the fluid, and the viscosity of the fluid. The results of these tests are shown on the Boring Logs.

F. Grading Analysis or Grain Size Distribution. The term "grain-size distribution" refers to the proportion or distribution of soil grains (particles) of different sizes which are contained in a given soil. The determination of the grain-size distribution of a soil, also called mechanical analysis, is accomplished by a screening process (sieve analysis). The results of these tests are given on Plates F through U.

G. Atterberg Limits. Clays and related fine-grained soils can be brought to a semiliquid consistency by mixing with water. When this moisture content is reduced by evaporation and the sample is remixed, the material is plastic or puttylike in consistency. If the moisture content is further reduced, the material becomes semisolid in consistency and cracks or crumbles when deformed. The range of moisture contents within which the material has a plastic consistency is called the plastic range. The upper and lower limits of the plastic range are defined by the Atterberg limits, i.e. the liquid limit and plastic limit. These tests were made to substantiate visual classifications. See Plate V.

H. Unconfined Compression Tests. The unconfined compression test is used to measure the shearing strength of cohesive soils, usually for the purpose of estimating the bearing capacity of a soil beneath a shallow foundation or the load-carrying capacity of a pile which is embedded in a soil of this type. The results of these tests on typical soils encountered in the borings are indicated on Plate W.

FOUNDATION RECOMMENDATIONS

Soil conditions are disclosed by our test borings. Conventional spread footings may be used to support the proposed structure if the recommendations contained in this report are followed.

It is recommended that all existing structures, underground lines and tanks be removed from the site. The demolition shall be done under the direction of the Soils Engineer. Part of the demolition contract shall include the recompaction of cavities resulting from demolition of underground structures under the supervision of the Soils Engineer.

The oil contaminated areas as delineated by the borings and shown on the attached map, are unsuitable for foundation support in their present condition. This material and any other such material encountered during demolition or by futher test borings, must be excavated to competent natural ground under the direction of the Soils Engineer, prior to the placement of any fill soils. The grading shall be done in accordance with the attached Specifications for Compacted Fill .

If the above recommendations are followed, the proposed structures may be founded on conventional spread footings a minimum of 18 inches beneath finished grade.

Available bearing value for the on-site materials are on the order of - 3000 lbs./sq.ft. to 5000 lbs./sq.ft. depending upon precise location of proposed structures, magnitude of loads and relationship of existing grade to final grade. Precise values should be determined by additional investigation when all variables are known.

Interior column footings may be founded directly on the certified dock high fills. The bearing value of this fill material should be on the order of - 2000 lbs./sq.ft. The precise values will be determined when the choice of import material is made and the appropriate tests performed.

The allowable soil pressures may be increased one-third for combinations of vertical and horizontal forces where permitted by the Uniform Building Code. No bearing value increases are recommended for increased width or embedment. If the proposed structures are founded as recommended, calculations indicate that differential settlements from building loads should not exceed 1/2 inch.

To prevent costly reinforcement of the concrete floor slabs, it is recommended that any imported soil used for slab support be non-expansive. Soil possessing an expansion of 3.0 percent or less under a surcharge load of 60 lbs./sq.ft. is considered non-expansive.

If the recommendations contained in this report are followed, floor slabs may be placed directly upon the compacted fills, provided import soils of a non-expansive nature are used.

All backfill adjacent to walls should be mechanically compacted to at least 90 percent of the maximum density obtainable by the ASTM Designation D-1557-67T method of compaction. Flooding should not be permitted.

Subsidence due to processing areas to receive fill is anticipated to be on the order of 0.1 to 0.2 ft.

A coefficient of friction of 0.4 may be assumed between the slabs on grade, the footings and the compact underlying soils. Compact soils around the footings may be assumed to develop passive earth pressures equivalent to those pressures exerted by a fluid having a density of 250 lbs./cu.ft. Active earth pressures against retaining walls will be equivalent to the pressures exerted by a fluid having a density of 30 lbs./cu.ft. for drained soils.

Computations for ultimate settlement based on the above recommended soil pressures and the results of consolidation-pressure curves indicate that all footings sized for the recommended soil pressure should experience long-term ultimate settlements of less than one-half inch. Due to the cohesive nature of the subsoils, the major portion of the settlement is expected to occur over many months after construction.

The foundation recommendations presented in this report are intended to be used for preliminary planning purposes only. A detailed foundation investigation should be performed for each structure in the development.

The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the present time, Western Laboratories should be notified so that supplemental recommendations can be given.

This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are called to the attention of the Architect and Engineers for the project and incorporated into the plans and that the necessary steps are taken to see that the Contractors and Subcontractors carry out such recommendations in the field.

This report is subject to review by the controlling authorities for the project.

We appreciate this opportunity to be of service to you.

Respectfully submitted,

WESTERN LABORATORIES

Jules J. Jaga, P.E.
R.C.E. 9537

SPECIFICATIONS FOR COMPACTED FILL

PREPARATION

The existing fill must be removed under the supervision of the Soils Engineer to competent natural ground.

After the foundation for the fill has been cleared, plowed or scarified, it shall be disced or bladed until it is uniform and free from large clods, brought to a proper moisture content and compacted to not less than 90% of the maximum dry density in accordance with ASTM:D-1557-67T (5 layers - 25 blows per layer; 10 lb. hammer - 18 inch drop; 4 inch diameter mold).

MATERIALS

On-site materials may be used for the fill, or imported fill materials shall consist of materials approved by the Soils Engineer, equal to or superior to the on-site soils and may be obtained from the excavation of banks, borrow pits or any other approved source. The materials used should be free of vegetable matter and other deleterious substances and shall not contain rocks or lumps greater than six inches in maximum dimension.

PLACING, SPREADING AND COMPACTING FILL MATERIALS

A. The selected fill material shall be placed in layers which when compacted shall not exceed six inches in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material and moisture of each layer.

B. Where the moisture content of the fill material is below the limits specified by the Soils Engineer, water shall be added until the moisture content is as specified, to assure thorough bonding and thorough compaction.

C. Where the moisture content of the fill material is above the limits specified by the Soils Engineer, the fill materials shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

D. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to not less than 90% of the maximum dry density in accordance with ASTM:D-1557-67T (5 layers - 25 blows per layer; 10 lb. hammer - 18 inch drop; 4 inch diameter mold) or other density tests which will attain equivalent results.

Compaction shall be by sheepsfoot roller, multi-wheel pneumatic tire roller or other types of acceptable rollers. Rollers shall be of such design that they will be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified moisture content. Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient trips to insure that the desired density has been obtained. The final surface of the lot areas to receive slabs-on-grade should be rolled to a dense, smooth surface.

E. The outside of all fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until the outer nine inches of the slope is at least 90% compacted. Compacting of the slopes must be done progressively in increments not to exceed fill height as the fill is brought to grade.

F. Field density tests shall be made by the Soils Engineer of the compaction of each layer of fill. Density tests shall be made at intervals not to exceed two feet of fill height provided all layers are tested. Where the sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches and density readings shall be taken in the compacted material below the disturbed surface. When these readings indicate the density of any layer of fill or portion thereof is below the required 90% density, the particular layer or portion shall be reworked until the required density has been obtained.

INSPECTION

The inspection by the Soils Engineer shall be made during all filling and compacting operations so that he can verify that the fill was made in accordance with the accepted specifications.

SEASONAL LIMITATIONS

No fill materials shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the field tests by the Soils Engineer indicate that the moisture content and density of the fill are as previously specified.

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 1
DATE DRILLED : 8/14/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
0		x		SANDY CLAY: fine sand, silty dark brown	117.0	16.3	47	21	32
5		x		CLAYEY-SILTY SAND: fine sand, light brown		15.0			
		x		SILTY SAND: fine sand, clayey, slightly micaceous, several sized brown clay pebbles, light brown	133.9	11.9			
10		x		SAND; fine sand, silty, micaceous, light brown	105.0	12.4			
15		x		SANDY CLAY: fine sand, slightly micaceous, light brown		18.3			
	x	x		Clay content increases to total depth		26.9			
20									
25		x			78.5	34.7			
				Total Depth 25.0 ft.					
30									

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 2
DATE DRILLED : 8/14/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0		x		CLAYEY SAND/SANDY CLAY: heavily oil saturated, brown to black, very viscous, sticky, odorous - Caving	123.3	13.8			
5									
10				Refusal old concrete slab					
				Total Depth 13.0 ft.					
15									
20									
25									

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 3
DATE DRILLED : 8/14/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
0				CLAYEY SAND: fine sand, dark brown					
	BAG			SANDY CLAY: fine sand,		16.2			
		x		slightly micaceous, dark brown	111.0	18.6			
5				SANDY CLAY/SANDY SILT: fine sand, micaceous, slightly lighter in weight, light tan to brown					
		x		SILTY SAND: fine sand, micaceous, light tan to brown		12.6			
10		x			115.2	20.7			
15				SILTY SAND: fine sand, micaceous, clayey, light tan to brown					
		x	19			11.8			
20									
		x		Pebbly inclusions, calcareous cement					
				Total Depth 25.0 ft.					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 4
DATE DRILLED : 8/15/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SANDY CLAY: fine sand, organic silty, dark brown and black					
	BAG			SANDY CLAY/CLAYEY SAND: fine sand, silty, light brown	92.0	15.8			
5				SILTY SAND: fine sand, clayey slightly micaceous, light brown					
		x	14			16.0			
10	BAG					14.5			
		x			116.0	12.1			
15				SILTY SAND; clayey, fine grained, micaceous, light brown					
		x	19			8.7			
20				SAND: fine sand, slightly silty, micaceous, several friable sand pebbles (dry), trace of greenish clay residue, light brown					
		x					87	6	7
				Total Depth 25.0 ft.					
30									

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 5 - Sheet 1 of 2
DATE DRILLED : 8/15/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
0		x		SANDY CLAY: fine sand, few small pebbles, silty, organic, dark brown and black	113.0	18.3	51	22	27
5				Color change to light brown					
		x	28	SILTY SAND: fine sand, slight clay content, light brown, several limonite stains zones		11.0			
10									
		x		SILTY SAND: fine sand, several pea sized friable sand pebbles, micaceous, slightl clay content light brown	121.0	17.0			
15									
		x	22	SANDY SILTY CLAY: fine sand, several friable sand pebbles, micaceous, light brown		30.2			
20				GRADATIONAL ZONE:					
	BAG			SILTY SAND: fine sand, micaceous, odorous, light green		18.8			
30		x		SAND: silty, fine to medium micaceous, odorous, greenish	108.5	4.9			

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 5 - Sheet 2 of 2
DATE DRILLED : 8/15/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
30									
				SANDY CLAY: fine sand, micaceous, fine organics, limonite staining, silty, light greenish tan					
35		x	19	SILTY SAND: fine sand, micaceous, odorous, fine organic matter, light greenish brown		16.9			
		x		SANDY SILTY: clayey, fine sand, micaceous, limonite stains, odorous, light greenish brown	95.2	27.0			
40				SILTY CLAY: fine sand, micaceous, odorous, limonite, light greenish brown					
	BAG	x	REF	SHELL FRAGMENTS: dense calcareous sand - shell bed, light tan sand with friable shell fragments		6.2			
45				CALCAREOUS SHELL BED: extremely dense, sand, clay, silt, light iron stained, tan (Coquina Limestone)					
				SANDY SILTY CLAY: fine sand, limonite, shell fragments, mottled tan to brown					
50				SAND: fine, silty, micaceous brown					
				Total Depth 50.0 ft.					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 6
DATE DRILLED : 8/15/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				GRASS SOD					
		x		SANDY CLAY: fine sand, organics, silty, dark brown	112.5	16.8	49	17	32
5				Color change to Brown					
0		x	14			17.1	58	25	23
		x		SILTY SAND: fine sand, micaceous, slight clay content, light brown	110.0	13.4			
5									
		x	15	CLAY/SILT: sandy, micaceous, light brown			48	22	30
20				numerous sand pebbles, friable from pea size to 1/2 inch					
	BAG			SAND: fine, micaceous, slightly silty		9.0	76	12	12
25				Total Depth 25.0 feet					
30									

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 7
DATE DRILLED : 8/18/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
0				SAND/GRAVEL FILL: loose					
				SANDY CLAY: silty, fine sand, dark brown					
5		x		Color change to brown	131.0	9.7	55	17	28
				SILTY SAND: fine sand, micaceous, brown - variable clay content					
10		x	30			12.9			
				Color change to tan					
		x				7.4			
15				SILTY CLAYEY SAND: fine sand, limonite, micaceous, tan					
				? ? ? ? ?					
		x	16	SANDY CLAYEY SILT: very fine sand, micaceous, limonite staining, tan		23.9			
20									
	BAG			numerous dark brown silty clay clods, moist to dry					
				Total Depth 25.0 ft.					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 8 Sheet 1 of 2
DATE DRILLED : 8/21/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
0				SAND/GRAVEL: Fill material, Reddish Brown					
		x	24	SANDY CLAY: silty, dark brown organic matter (black)					
5				CLAYEY SAND: silty, fine sand reddish brown					
		x		SILTY SAND: clayey, fine sand reddish brown changing to brown, slightly micaceous	127.0	9.6			
10									
		x	21			12.2			
15		x				16.6			
		x		SAND: silty, light brown, slightly gaseous odor	109.3	12.3			
20				SILTY CLAYEY SAND: fine, micaceous, brown Limonite Staining					
				SILTY SAND: fine sand, micaceous, slight gas odor, limonite, variable clay and silt content, brown					
		x	32	SAND: silty, micaceous, fine, very odorous (variable in zones)		6.2			
20									

WESTERN LABORATORIES

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 8 Sheet 2 of 2
DATE DRILLED : 8/21/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
30									
		x		SILTY CLAYEY SAND: fine sand, micaceous, limonite, brown	112.9	15.5			
35									
40	x			SILTY SAND-SHELL BED: fine sand, micaceous, limonite stains, numerous shell fragments		19.1			
				SILTYSAND: fine, micaceous, heavy limonite staining					
45	x			SILTY SAND/SANDY SILT: fine sand, micaceous slightly odorous, heavy limonite staining, vari-colored-grey-green-brown, clayey	100.0	18.9			
50									
				SAND: silty, fine, micaceous, limonite, heavy odor, greenish grey					
				SHELL FRAGMENTS					
				CLAY: silty, odorous, micaceous limonite staining, fine sand, brown					
60									

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PROJECT :

FOR :

BORING NUMBER : 9

DATE DRILLED : 8/18/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SURFACE GRAVEL: loose					
				SANDY CLAY: fine sand, dark brown					
		x		SANDY CLAY: Color change to brown, fine sand	108.0	15.5			
5				CLAYEY SAND: silty, micaceous minor clay content, brown					
		x	25	SILTY SAND: fine sand, micaceous, minor clay content, brown		11.4			
10				Slight gaseous odor					
		x		SILTY SAND: fine sand, micaceous, limonite, numerous dense silty sand inclusions, tan		10.8			
15				SAND: silty, fine, micaceous, light tan					
				CLAYEY SAND: fine, micaceous, limonite, brown					
		x	17	SANDY SILT: clayey, fine sand, micaceous (gas) odorous, greenish brown		26.0			
20				SANDY SILT: color changes to green, continued odor					
				SANDY SILT: fine sand, micaceous, limonite stains, heavy gas odor, greenish brown					
				SILTY SAND: fine sand, micaceous, limonite gas odor, greenish brown					
				SAND: fine to medium, tan					
				Total Depth 25.0 feet					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 10
DATE DRILLED : 8/18/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SURFACE GRAVEL: loose					
		x	25	SANDY CLAY: fine, limonite stained, organics, dark brown to brown		17.5			
5		x		SILTY CLAYEY SAND: fine, brown, limonite staining	102.5	18.8	65	14	21
10	BAG					17.4			
15				Change of color to Light Brown					
20		x	19	SANDY CLAYEY SILT: fine sand, odorous (gas), micaceous, tan		23.6			
		x		CLAYEY SAND: silty, micaceous limonite stained, fine sand, tan, odorous	97.2	26.5			
				Total depth 25.0 feet					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 11
DATE DRILLED : 8/16/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				ASPHALTIC CONCRETE					
		x	8	SANDY CLAY: silty, fine sand, organics, scattered friable sand pebbles, dark brown		14.7			
5				Color change to light brown					
		x		SILTY SAND: clayey, fine sand, very fine mica, light brown	122.5	11.3			
10				Limonite staining and minor clay					
		x	16			8.7			
15				SAND: silty, fine sand, micaceous, tan					
		x		SILTY SAND: fine sand, micaceous, fine organics, limonite, several hard (±) 2" inclusions, light tan		17.7			
20	BAG					18.1			
				Total Depth 25.0 feet					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 12
DATE DRILLED : 8/16/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
0				ASPHALTIC CONCRETE					
		x		CLAYEY SAND: silty, fine sand, reddish brown, micaceous		17.3			
5				Variable between silty & clayey					
		x	15			11.0			
10									
		x			92.3	29.9			
15									
		x	15	SILTY CLAYEY SAND: limonite		32.3			
20									
				SILTY SAND: fine, greenish brown					
				Total Depth 25.0 feet					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 13
DATE DRILLED : 8/16/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				FILL: Clay, brown to dark brown pebbly					
5		x	11	SANDY CLAY: fine sand, few sand pebbles, (friable), dark brown, minor organic (black)		19.5			
				Change of color to light brown					
		x			121.0	16.5			
10				SILTY SAND: clayey, fine sand, micaceous, light brown					
15		x	13			14.3			
		x			103.5	12.2			
20				SILTY CLAY: fine sand, micaceous, light brown, limonite stains					
				Total depth 25.0 feet					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 14
DATE DRILLED : 8/16/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SAND/CLAY/SILT - fill material concrete, rubble, etc.					
		x		SANDY CLAY: fine sand, silty, dark brown, black organics Color change to brown with mica	118.0	16.2	51	11	38
5									
		x		CLAYEY SAND: silty, micaceous fine sand, brown, very dense, limonite		18.0			
10									
		x		SAND: slight silt content, fine grained, micaceous, brown, limonite stained	123.2	8.8			
15									
		x		SAND: silty, clayey, micaceous limonite, brown		14.1			
20									
				Total depth 25.0 feet					

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PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 15 Sheet 1 of 2
DATE DRILLED : 8/17/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SURFACE GRAVEL - loose					
		x		SANDY CLAY: silty, fine sand, small friable pebbles, reddish brown	133.0	13.9			
5				SILTY SAND: clayey, fine sand, few pea sized clay pebbles, reddish brown					
		x		Limonite stains & micaceous	116.5	12.9	60	22	18
10									
		x	14			20.0			
15				Color change to brown					
20		x	26	CLAYEY SAND: fine sand, silty, micaceous, limonite stains		27.4			
				fine white lime (?) inclusions					
	AG					12.5			
				SILTY SAND: fine, micaceous, minor clay, brown					
		x		SAND: fine sand, clean, micaceous, tan, several pea sized clay inclusions	116.5	5.7			
30									

Vol. III of III

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 15 Sheet 2 of 2
DATE DRILLED : 5/17/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
30									
		x	26	SAND: fine to medium, clean, micaceous, tan		7.8			
				SILTY CLAYEY SAND: mica. fine					
35				SAND-SILT-CLAY: mixed, micaceous, limonite stained clay lumps (+) pea sized, mottled tan and brown					
	BAG			SILTY-CLAYEY-SAND; fine, micaceous, limonite stained, brown clay lumps to 1"					
40		x		SAND: silty, micaceous, fine sand, silty clay inclusions, tan	95.5	20.5			
45				SILTY SANDY CLAY: calcareous, limonite, micaceous, numerous shell fragments, greenish tan					
	BAG			CLAY: calcarous, numerous shell fragments, limonite, greenish tan		14.7			
50				COQUINA: numerous, fragments dense, well cemented, brown to tan					
				SILTY SAND: fine, micaceous, reddish brown					
				Total depth 51.0 feet					
60									

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 16
DATE DRILLED : 8/17/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS % SAND	% SILT	% CLAY
0				GRASS, SOD, ROOTS					
				SANDY CLAY: fine sand, silty, organics (roots), dark brown					
5		x		SANDY CLAY: fine sand, silty silty, reddish brown, variable sand content, micaceous	117.8	16.5			
	BAG					17.8			
		x				16.1			
10									
15				SILTY CLAYEY SAND: fine, several clay lumps, micaceous reddish brown					
		x		SILTY SAND: fine sand, micaceous, light brown, limonite	113.0	10.9			
20				Scattered clay inclusions, greater clay content					
	BAG					18.9			
				Total Depth 25.0 feet					

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 17
DATE DRILLED : 8/17/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SURFACE GRAVEL - loose					
				SAND: silty, clayey, dark brown					
		x		SANDY CLAY: silty, red		16.0			
5									
		x	13	SILTY SAND: slight clay content fine sand, several small clay lumps (±) 1/2", reddish brown	18.5	15.1			
10	BAG			increased clay content		14.1			
		x			123.0	13.1			
15				Decrease in clay content					
		x	28	SILTY SAND: fine sand, variable clay content, micaceous light brown, several 2" sized brown clay inclusions		10.3			
20									
				Total Depth 25.0 feet					

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 18
DATE DRILLED : 8/17/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SURFACE GRAVEL - loose					
		x		SILTY SAND: fine sand, hard dark brown clay clods (broken fragments) micaceous, red	115.5	13.1			
5									
		x	25	Gradual color change to Brown		12.5	83	8	9
0									
		x		SILTY SAND: fine sand, micaceous, numerous silty clay lumps, brown		7.1			
5				SAND: silty, micaceous, fine grained, brown					
		x			115.5	14.4			
20				Gradual color change to Light Brown					
	BAG					11.0			
25				Total Depth 25.0 feet					

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 19
DATE DRILLED : 8/18/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SILTY SAND - fine sand, clayey dark brown					
				SANDY CLAY: silty, fine sand, limonite staining, reddish brown					
5		x		SILTY SAND: clayey, fine sand numerous clay inclusions, limonite stains, brown Note: Silt & Clay content variable	122.0	10.7			
		x	23	CLAYEY SAND: silty, fine, micaceous, brown		17.2	66	16	18
10				SILTY SAND: clayey, micaceous fine sand, brown					
15		x							
				Color change to light brown and limonite staining					
20		x	24			16.7			
25				Total Depth 25.0 feet					

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 20
DATE DRILLED : 8/21/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SAND/GRAVEL: loose					
				SILTY SANDY CLAY: fine sand, fill material, soft, dark brown					
5		x		SANDY CLAY: silty, fine sand, brown (in-situ)	111.0	15.6	66	18	16
10				SILTY SAND: clayey, fine sand, brown					
15		x	16	SILTY SAND: fine sand, micaceous, brown, clayey		12.8			
20				SILTY SAND: clayey, micaceous fine grained, limonite stained, brown					
		x			96.7	36.6			
				Total Depth 25.0 feet					

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 21
DATE DRILLED : 8/21/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SAND/GRAVEL: loose					
				SANDY CLAY: silty, dark brown					
5		x		Color change to reddish brown, scattered pebbles (no. 8)		13.3			
10									
15				SILTY SAND: clayey, micaceous fine sand, color change to Brown					
20		x		SAND: silty, scattered clay inclusions, fine sand, micaceous, Brown		6.5			
				Total depth 25.0 feet					

WESTERN LABORATORIES

W.O. 4999

PROJECT : SHELL OIL FACILITY
FOR : CABOT, CABOT & FORBES

BORING NUMBER : 22
DATE DRILLED : 8/22/72

DEPTH FT.	SAMPLE	CORE	BLOWS/FT.	LITHOLOGY	UNIT DRY WEIGHT LBS/CU.FT.	% MOISTURE	ANALYSIS		
							% SAND	% SILT	% CLAY
0				SAND/GRAVEL: loose					
				SANDY CLAY: silty, organics, fine sand, dark brown					
5		x		Color change to reddish brown	116.0	14.3	60	21	19
10									
				SILTY SAND: fine sand, brown slightly clayey					
15		x				10.7			
				SILTY-CLAYEY SAND: fine sand; micaceous, scattered hard clay inclusions, brown					
20									
				SANDY SILTY CLAY: fine sand, micaceous, brown					
		x			93.4	26.3			
25				Total Depth 25.0 feet					

Work Order 4990

TABLE I

CONTAMINATED AREA INVESTIGATION

Depth (in ft.)	Boring No. 1-A	Date - 8/22/72
0.0 - 4.0	Sandy Clay, Dark Brown, moist	
4.0 - 5.0	Oil saturated Clay, sandy, odorous	
5.0 - 6.0	Sandy, silty, Clay, Reddish Brown, moist	
	Boring No. 1-B	**Date - 8/22/72**
0.0 - 1.0	Fill, sandy Clay, Dark Brown	
1.0 - 5.0	Oil saturated Clay, sandy, odorous, fine sand	
5.0 - 10.0	Sandy Clay, silty, fine Sand, Reddish Brown, moist	
	Boring No. 1-C	**Date - 8/22/72**
0.0 - 2.0	Sandy Clay, Dark Brown, moist	
2.0 - 5.0	Oil saturated Clay, sandy, odorous	
5.0 - 6.0	Sandy, silty, Clay, Reddish Brown, moist, fine Sand	
	Boring No. 1-D	**Date - 8/22/72**
0.0 - 2.0	Sandy, Clay, silty, fine Sand, Light to Dark Brown	
2.0 - 5.0	Oil saturated Clay, sandy, odorous	
5.0 - 6.0	Sandy Clay, fine Sand, Reddish Brown, moist	

TABLE I
Continued

Depth (in ft.)	Boring No. 1-E	Date - 8/22/72
0.0 - 1.0	Sandy, Clay, silty, fine Sand, Light to Dark Brown	
1.0 - 6.0	Oil saturated Clay, sandy, odorous, fine Sand	
6.0 - 9.0	Sandy Clay, silty, fine Sand, Reddish Brown, moist	
	Boring No. 1-F	**Date - 8/22/72**
0.0 - 0.5	Sandy, Clay, silty, fine Sand, Light to Dark Brown	
0.5 - 4.0	Oil saturated Clay, sandy, odorous, fine Sand	
4.0 - 6.0	Sandy Clay, silty fine Sand, Reddish Brown, moist	
	Boring No. 1-G	**Date - 8/22/72**
0.0 - 5.0	Fill, sandy Clay, Dark Brown	
5.0 - 7.0	Oil saturated Clay, sandy, odorous, fine Sand	
7.0 - 8.0	Sandy Clay, silty, fine Sand, Reddish Brown, moist	
	Boring No. 1-H	**Date - 8/22/72**
0.0 - 1.0	Fill, sandy Clay, Dark Brown	
1.0 - 5.0	Oil saturated Clay, sandy, odorous, fine Sand	
5.0 - 7.0	Sandy Clay, silty, fine Sand, Reddish Brown, moist	

TABLE I
Continued

Depth (in ft.)	Boring No. 1-I	Date - 8/22/72
0.0 - 2.5	Fill, sandy Clay, Dark Brown	
2.5 - 6.0	Oil saturated Clay, sandy, odorous, fine Sand	
6.0 - 8.0	Silty Sand, Green	
	Boring No. 2-A	**Date - 8/22/72**
0.0 - 0.5	Oil saturated Clay, sandy, odorous, fine Sand	
0.5 - 13.0	Oil saturated Clay, sandy, odorous, fine Sand	
13.0 -	Hole Collapsed	
	Boring No. 2-B	**Date - 8/22/72**
3.0 - 4.0	Sandy Clay, fine Sand, Light to Dark Brown, moist	
4.0 - 7.5	Oil saturated Clay, heavy oil tar	
7.5 -	Refusal - Concrete Slab?	
	Boring No. 2-C	**Date - 8/22/72**
0.0 - 8.0	Sandy Clay, silty, fine Sand, scattered pebbles to cobbles, Dark Brown	
8.0 - 23.0	Oil saturated Clay, tarry, soft, moist to wet	
23.0 -	Hole collapsed	

TABLE I
Continued

Depth (in ft.)	Boring No. 2-D — Date - 8/22/72
0.0 - 2.0	Sandy Clay, silty, fine Sand, few pebbles, Dark Brown, moist
2.0 - 21.0	Oil saturated Clay, silty, fine Sand, scattered pebbles and cobbles to 3 inches, odorous, heavy oil saturation, Dark Brown to Black
21.0 - 30.0	Sandy Clay, silty, fine Sand, pebbles to 1/2", Light to Dark Brown
	Boring No. 2-E — Date - 8/22/72
0.0 - 4.0	Sandy Clay, silty, fine Sand, angular pebbles and gravel, Light to Dark Brown, slightly moist
4.0 - 6.0	Color change to Brown
6.0 - 10.0	Silty Sand, clayey, fine Sand, scattered hard Clay inclusions, Greenish Brown, moist
	Boring No. 2-F — Date - 8/22/72
0.0 - 2.0	Sandy Clay, silty, fine Sand, angular pebbles and gravel, Light to Dark Brown, slightly moist
2.0 - 5.0	Sandy Clay, fine Sand, Dark Brown, moist
5.0 - 8.0	Color change to Brown
8.0 - 10.0	Silty Sand, clayey, fine Sand, micaceous, limonite stained, Brown, moist

TABLE I
Continued

Depth (in ft.)	Boring No. 1-X	Date - 8/22/72
0.0 - 3.0	Sandy Clay, silty, fine Sand, angular pebbles and gravel, Light to Dark Brown, slightly moist	
3.0 - 4.0	Color change to Brown	

TABLE I
Continued

Test Pit No.	Depth to Base of Contaminated Area (in ft.)
P-1	5.0
P-2	5.0
P-3	4.0
P-4	10.0
P-5	6.5
P-6	11.0
P-7	10.0
P-8	7.0
P-9	4.0
P-10	7.0
P-11	7.0
P-12	4.0
P-13	6.0
P-14	10.0
P-15	12.0
P-16	12.0
P-17	16.0
P-18	11.0
P-19	8.0
P-20	14.0
P-21	8.0
P-22	12.0
P-23	15.0
P-24	-0-
P-25	-0-
P-26	16.0
P-27	7.0
P-28	3.0
P-29	5.0
P-30	10.0
P-31	-0-
P-32	-0-
P-33	8.0
P-34	7.0

TABLE I
Continued

Depth (in ft.)	Test Pit B-23	Date - 8/25/72
0.0 - 5.0	Oil Saturated Clay, Black to Dark Brown, fine Sand, silty, organic matter, odorous, moist	
5.0 - 10.0	Clay, silty to sandy, fine Sand, Green, chemically saturated, odorous, moist	
	Test Pit B-24	**Date - 8/28/72**
0.0 - 0.5	Silty Sand, fine, Light Tan	
0.5 - 1.0	Sandy Clay, slightly odorous, Dark Brown, moist	
1.0 - 5.0	Sandy Clay, Dark Brown, moist	
5.0 - 8.0	Clayey, silty Sand, fine Sand, Brown, moist	
	Test Pit B-25	**Date - 8/28/72**
0.0 - 6.0	Clayey, silty Sand, Brown to Dark Brown, slight chemical odor	
	Test Pit B-26	**Date - 8/28/72**
0.0 - 0.5	Bituminous Paving Material	
0.5 - 5.0	Sandy Clay, Dark Brown, moist	
5.0 - 8.0	Sandy, silty Clay, Brown, moist	

TABLE I
Continued

Depth (in ft.)	Test Pit B-27	Date - 8/28/72
0.0 - 0.5	Silty Sand, fine, Tan	
0.5 - 6.0	Sandy Clay, Dark Brown, moist	
6.0 - 8.0	Sandy Clay, Brown, moist	
	Boring No. 2 - Backhoe Retest	- 8/28/72
	(Refer to Auger Log of Boring No. 2)	
0.0 - 14.0	Heavy oil saturation, lots of foreign matter, wood, clay pipe, metal, concrete, etc. Rough dimension of slab at total depth is 4' x 5' x 6 inches.	
	Hole cratered to 15' x 15' at top	

TABLE II

DIRECT SHEAR TESTS

Boring No.	Depth in ft.	Cohesion Lbs./Sq.Ft.	Angle of Internal Friction (degrees)
6	3.5	1200	24
7	3.5	1100	26
10	8.5	900	30
11	8.5	800	32
15	8.5	1400	26
19	4.5	1450	28
20	6.0	1400	24
22	4.0	1300	29

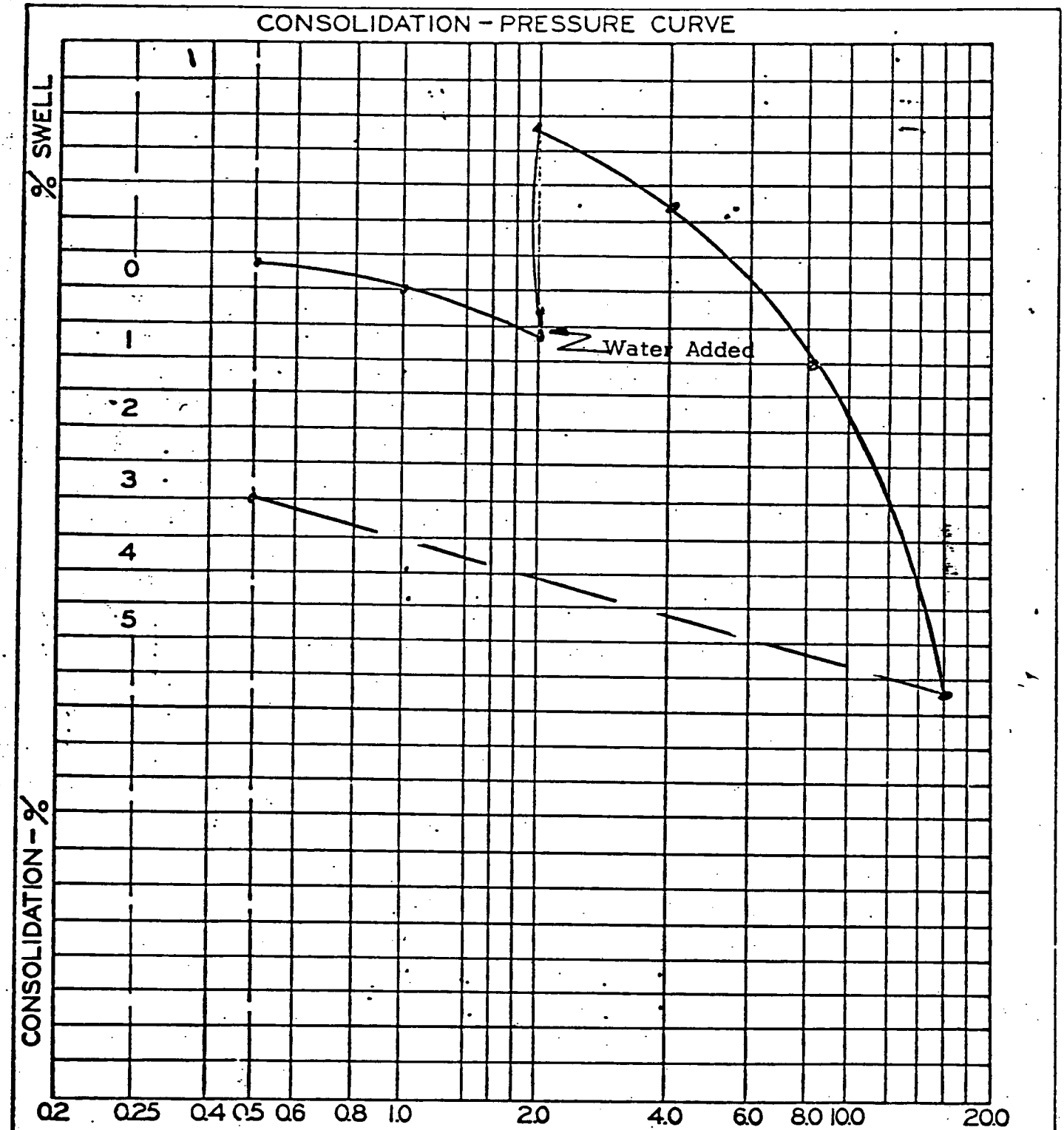
TABLE III

EXPANSION TESTS

Boring No.	Depth in ft.	Percent Expansion
6	3.5	9.5
7	3.5	4.4
10	8.5	5.2
11	8.5	2.3
15	8.5	7.5
16	4.5	7.6
20	6.0	2.3
24	4.0	2.9

BORING Nº 6
DEPTH 3.5

Soil Type - Clay, sandy



NORMAL LOAD
IN KIPS PER SQUARE FOOT

PLATE A

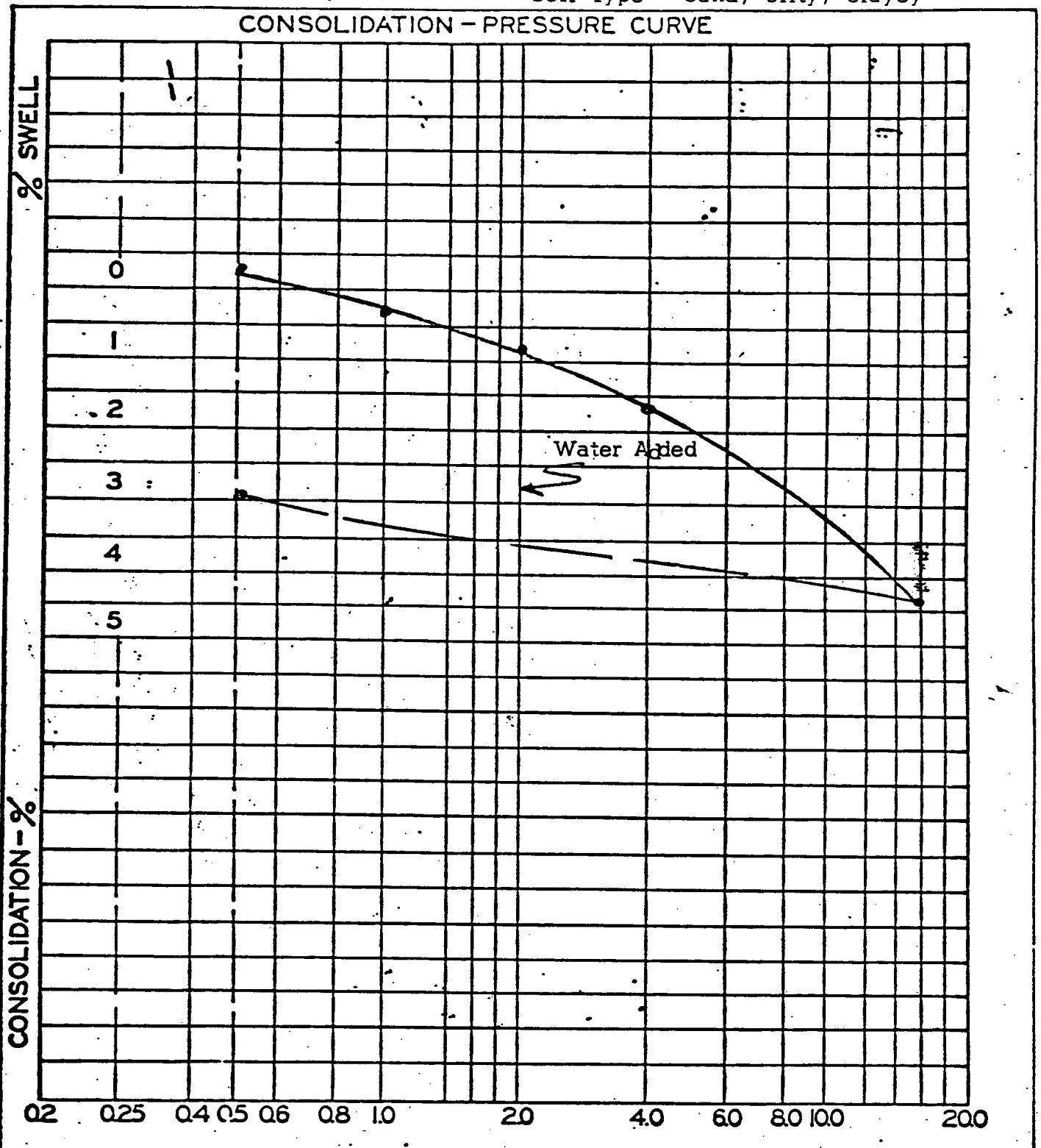
DATE: 9/11/72
SCALE:
WORK ORDER: 4999

PREPARED FOR
CABOT, CABOT & FORBES

WESTERN LABORATORIES
13626 S. NORMANDIE AVENUE
GARDENA, CALIFORNIA

BORING Nº 6
DEPTH 13.5

Soil Type - Sand, silty, clayey



NORMAL LOAD
IN KIPS PER SQUARE FOOT

PLATE B

DATE: 9/11/72
SCALE:
WORK ORDER: 4999

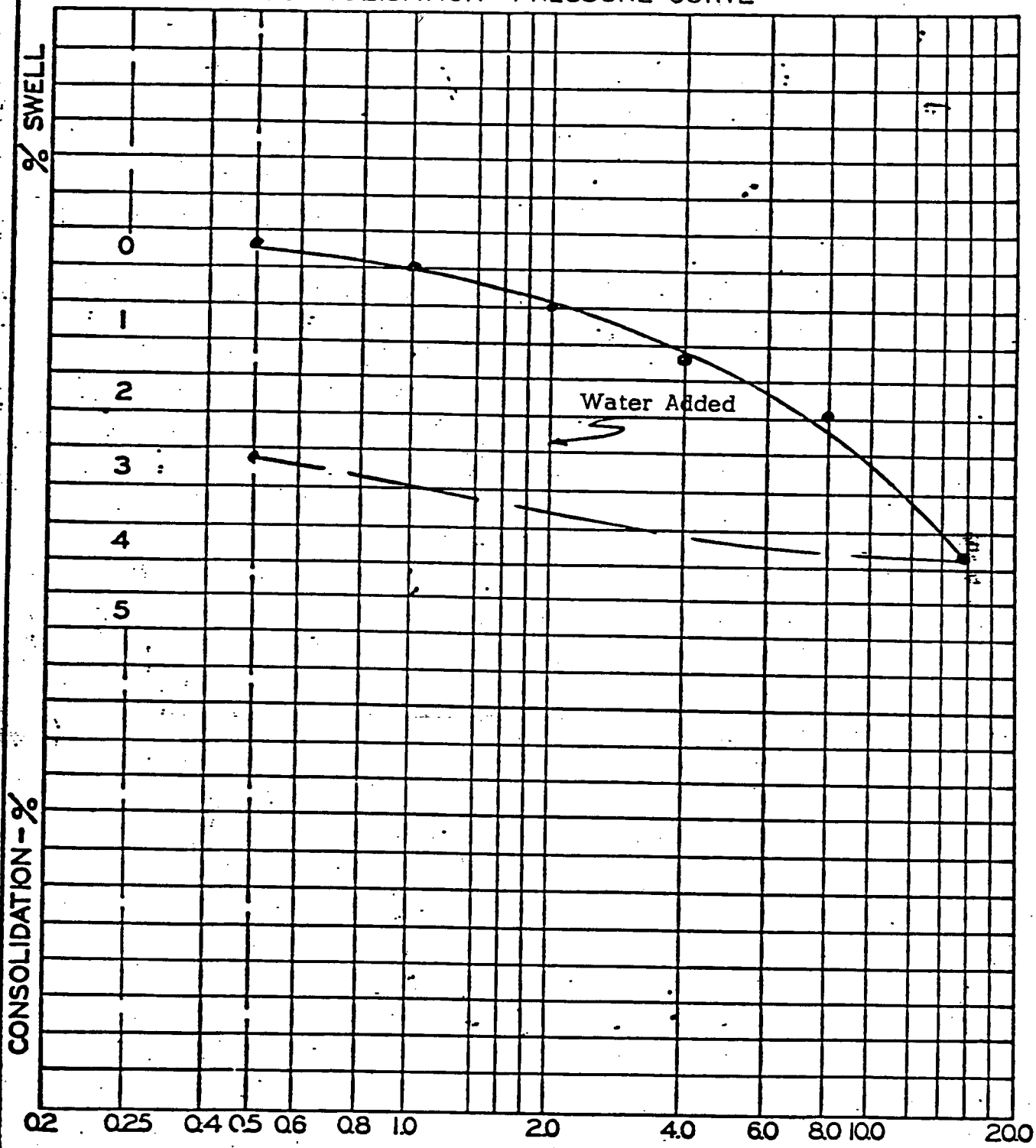
PREPARED FOR -
CABOT, CABOT & FORBES

WESTERN LABORATORIES
13626 S. NORMANDIE AVENUE
GARDENA, CALIFORNIA

BORING Nº 15
DEPTH 8.5

Soil Type - Sand, silty

CONSOLIDATION - PRESSURE CURVE



NORMAL LOAD
IN KIPS PER SQUARE FOOT

PLATE C

DATE: 9/11/72
SCALE:
WORK ORDER: 4999

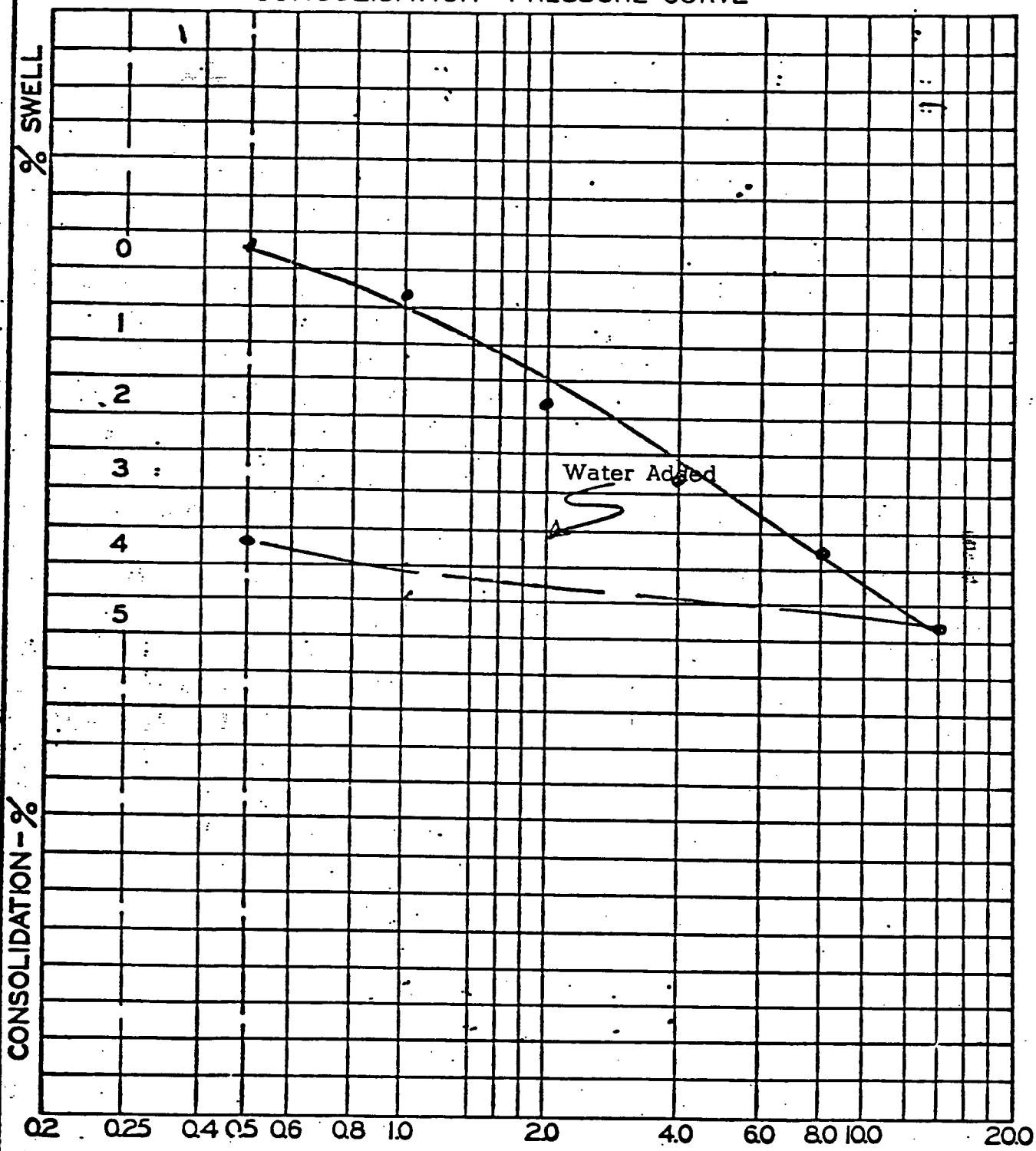
PREPARED FOR -
CABOT, CABOT & FORBES

WESTERN LABORATORIES
13626 S. NORMANDIE AVENUE
GARDENA, CALIFORNIA

BORING Nº 16
DEPTH 4.5

Soil Type - Clay sandy

CONSOLIDATION - PRESSURE CURVE



NORMAL LOAD
IN KIPS PER SQUARE FOOT

PLATE D

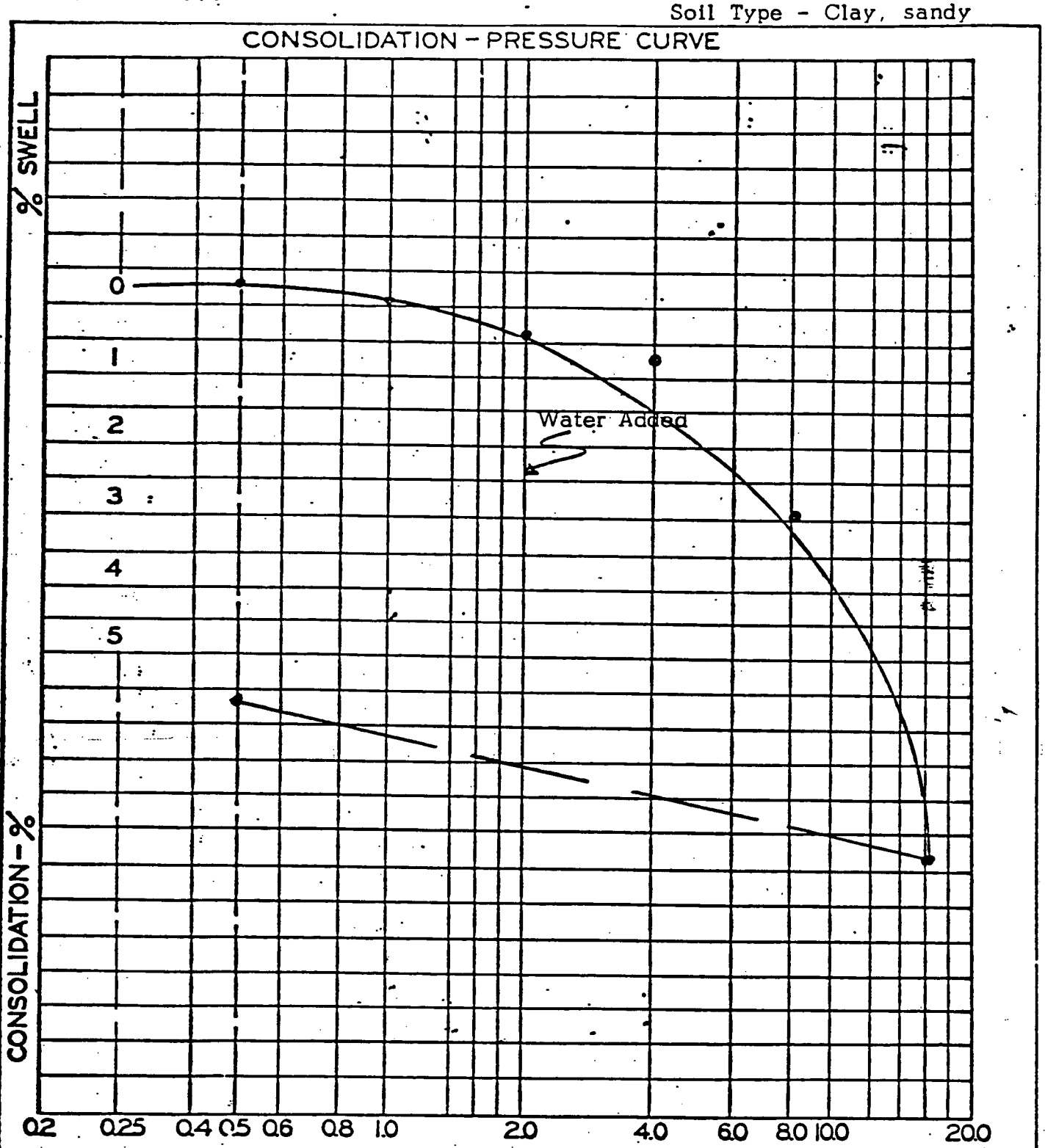
DATE: 9/11/72
SCALE:
WORK ORDER: 4999

PREPARED FOR -
CABOT, CABOT & FORBES

WESTERN LABORATORIES
13626 S. NORMANDIE AVENUE
GARDENA, CALIFORNIA

BORING Nº 20
DEPTH 6.0

Soil Type - Clay, sandy



NORMAL LOAD
IN KIPS PER SQUARE FOOT

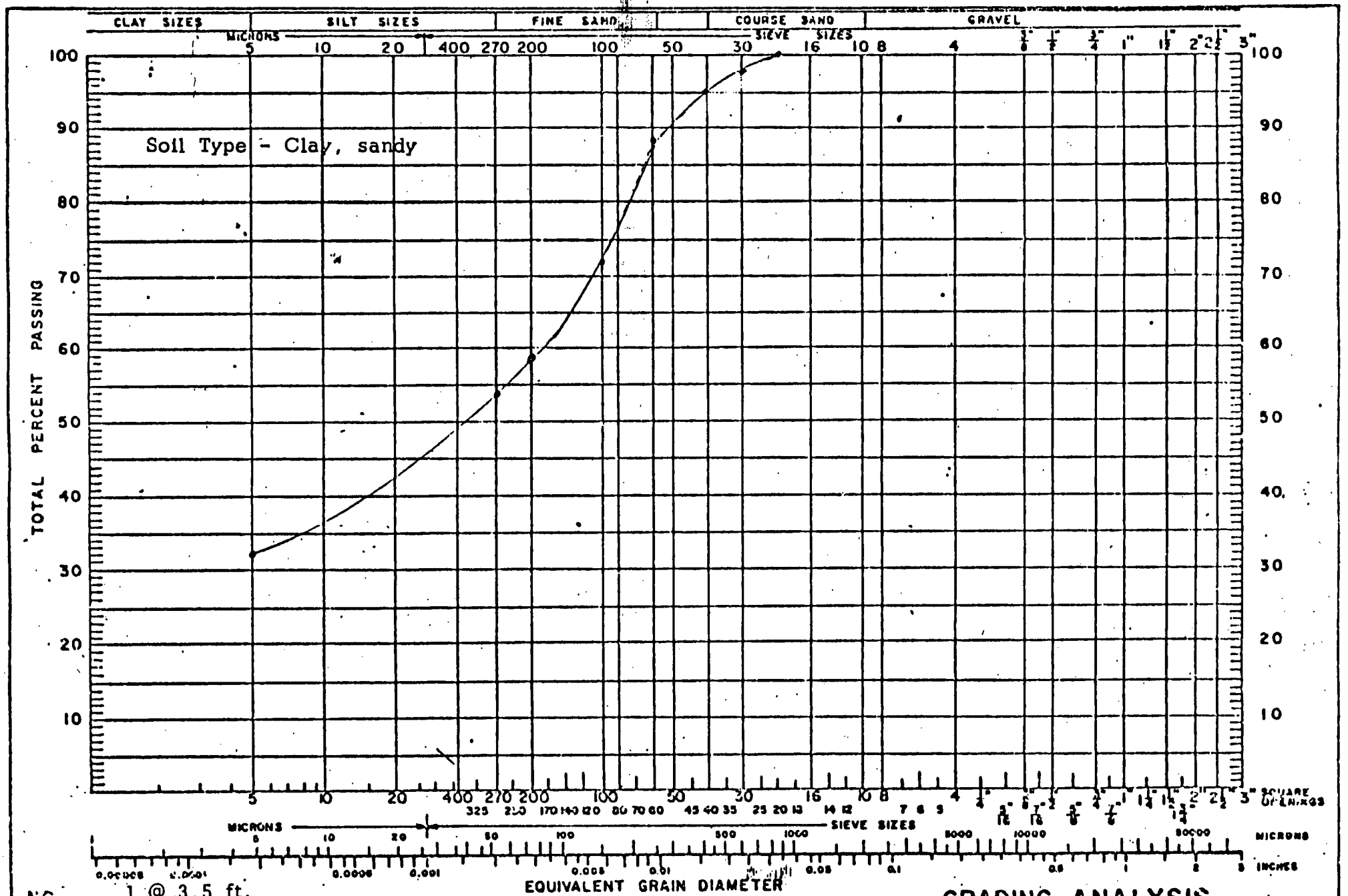
PLATE E

DATE: 9/11/72
SCALE:
WORK ORDER: 4999

PREPARED FOR -
CABOT, CABOT & FORBES

WESTERN LABORATORIES
13626 S. NORMANDIE AVENUE
GARDENA, CALIFORNIA

PLATE F



NO. 1 @ 3,5 ft.

DATE 9/11/72 BY C.W.

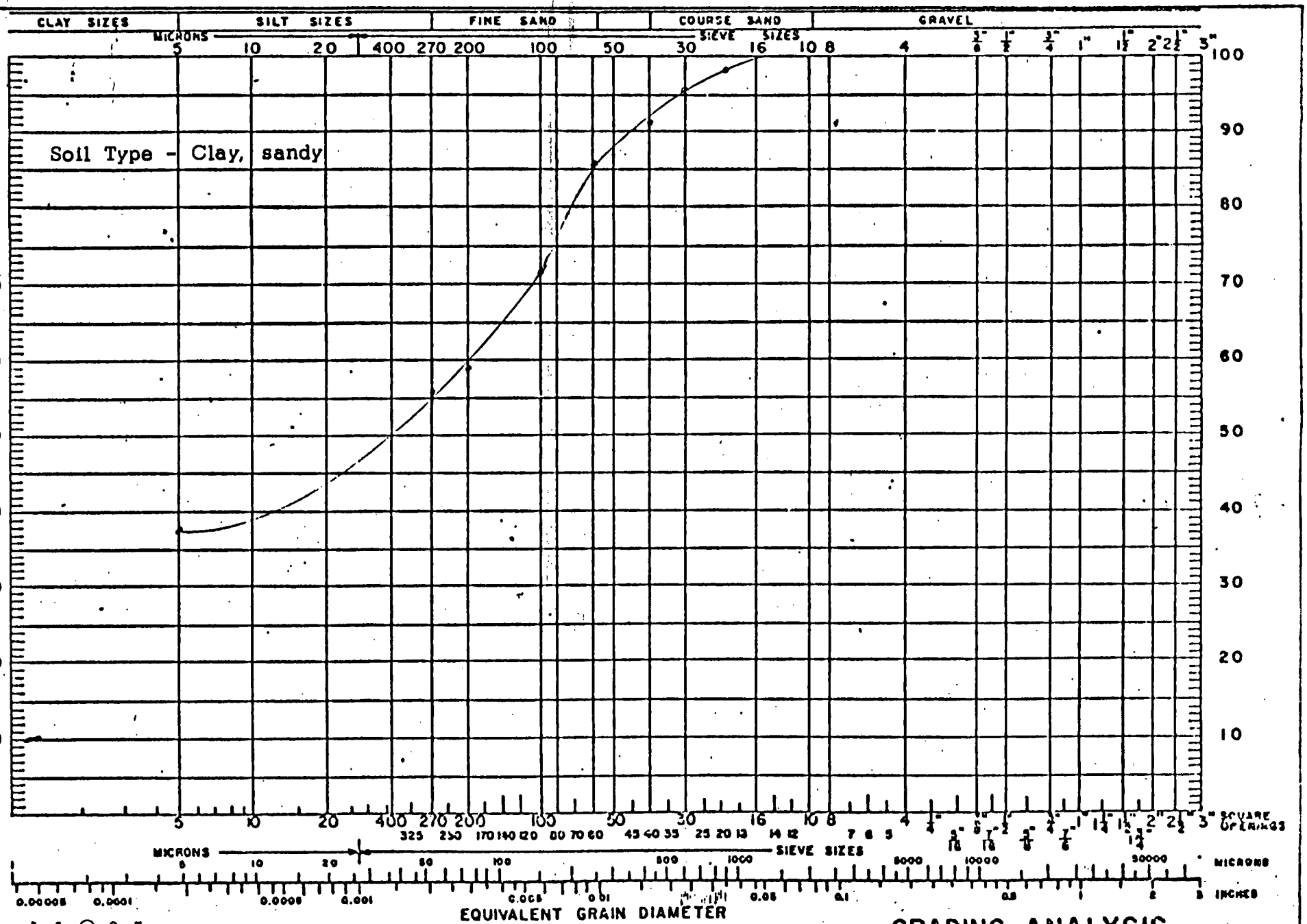
LOCATIO! Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 499

FIGURE NO.

PLATE G



NO A-1 @ 3.5

DATE 9/11/72 BY C.W.

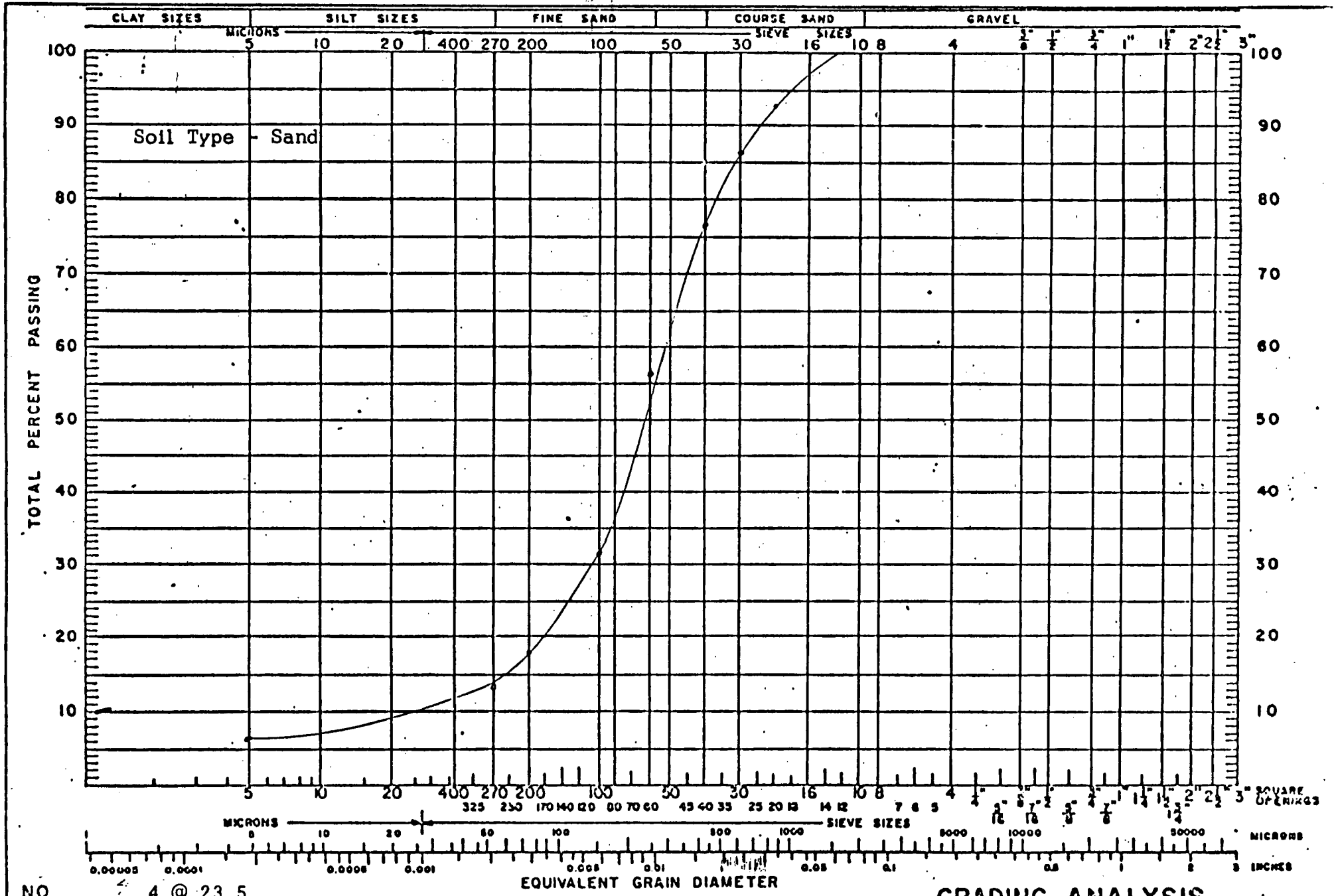
LOCATIO Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4999

FIGURE NO.

PLATE H



NO. 4 @ 23.5

DATE 9/11/72 BY C.W.

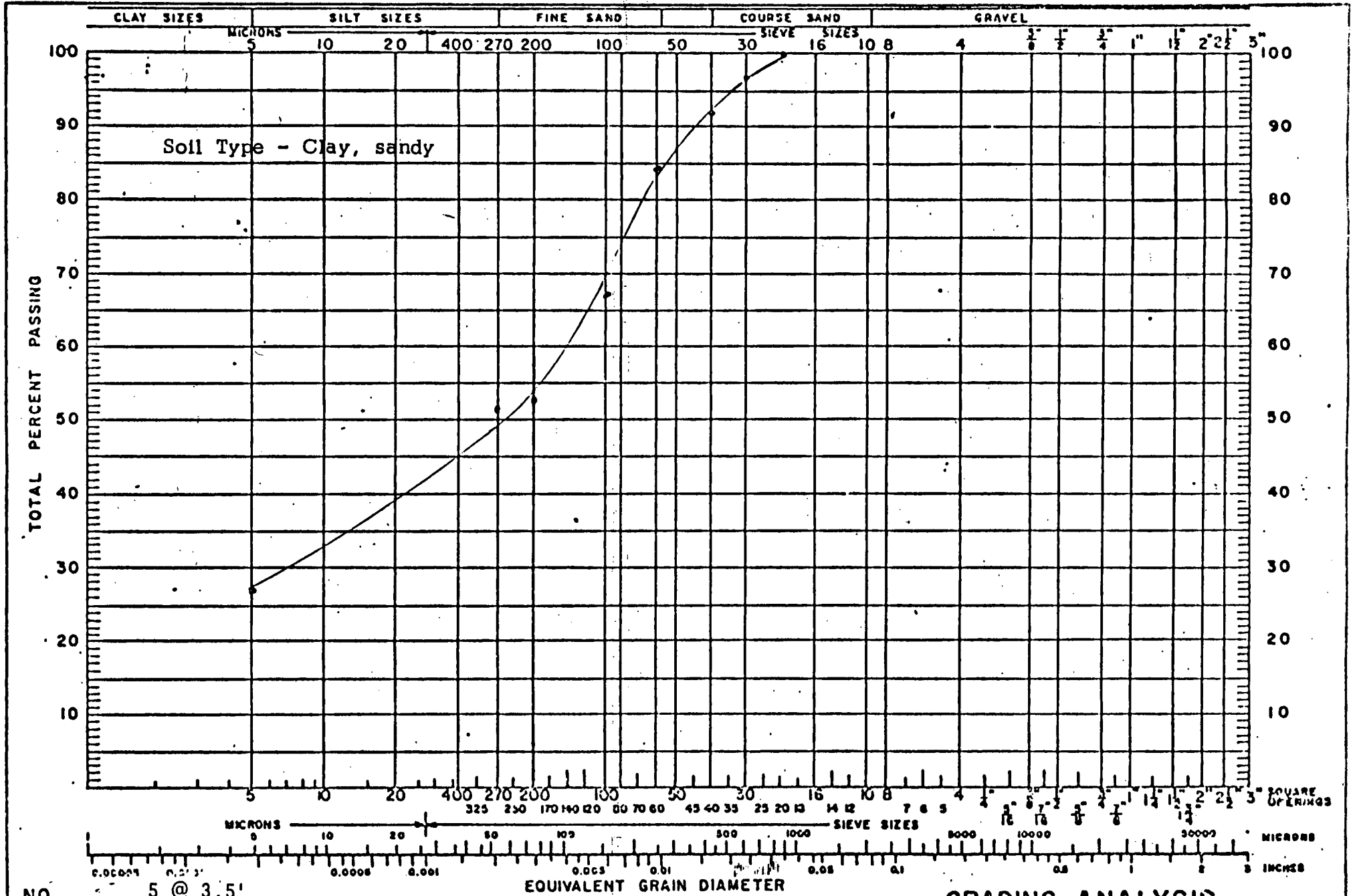
LOCATI Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4995

FIGURE NO.

PLATE I



NO. 5 @ 3.5'

DATE 9/11/72 BY C.W.

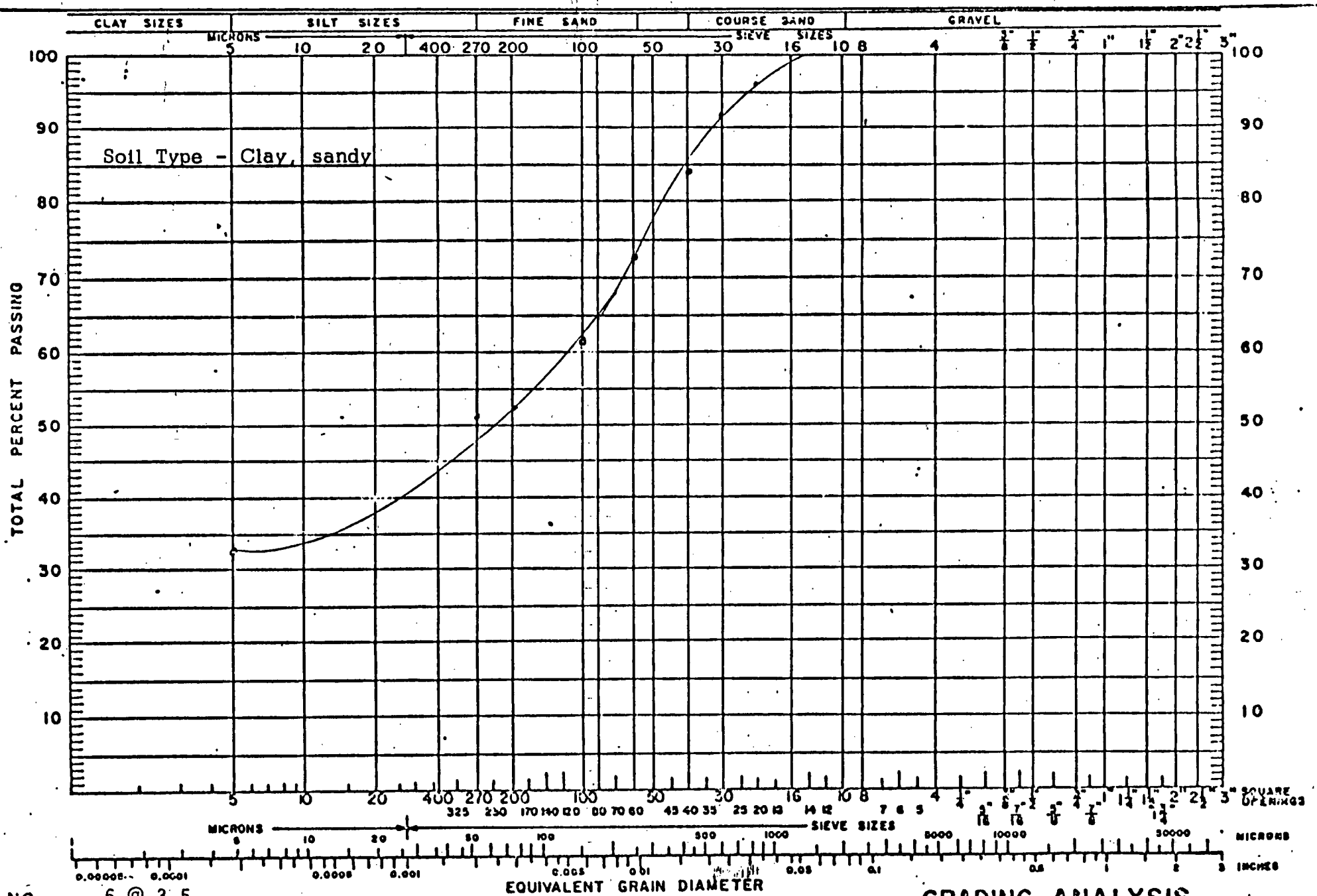
LOCATIC Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4995

FIGURE NO.

PLATE J



NO. 6 @ 3.5

DATE 9/11/72 BY C.W.

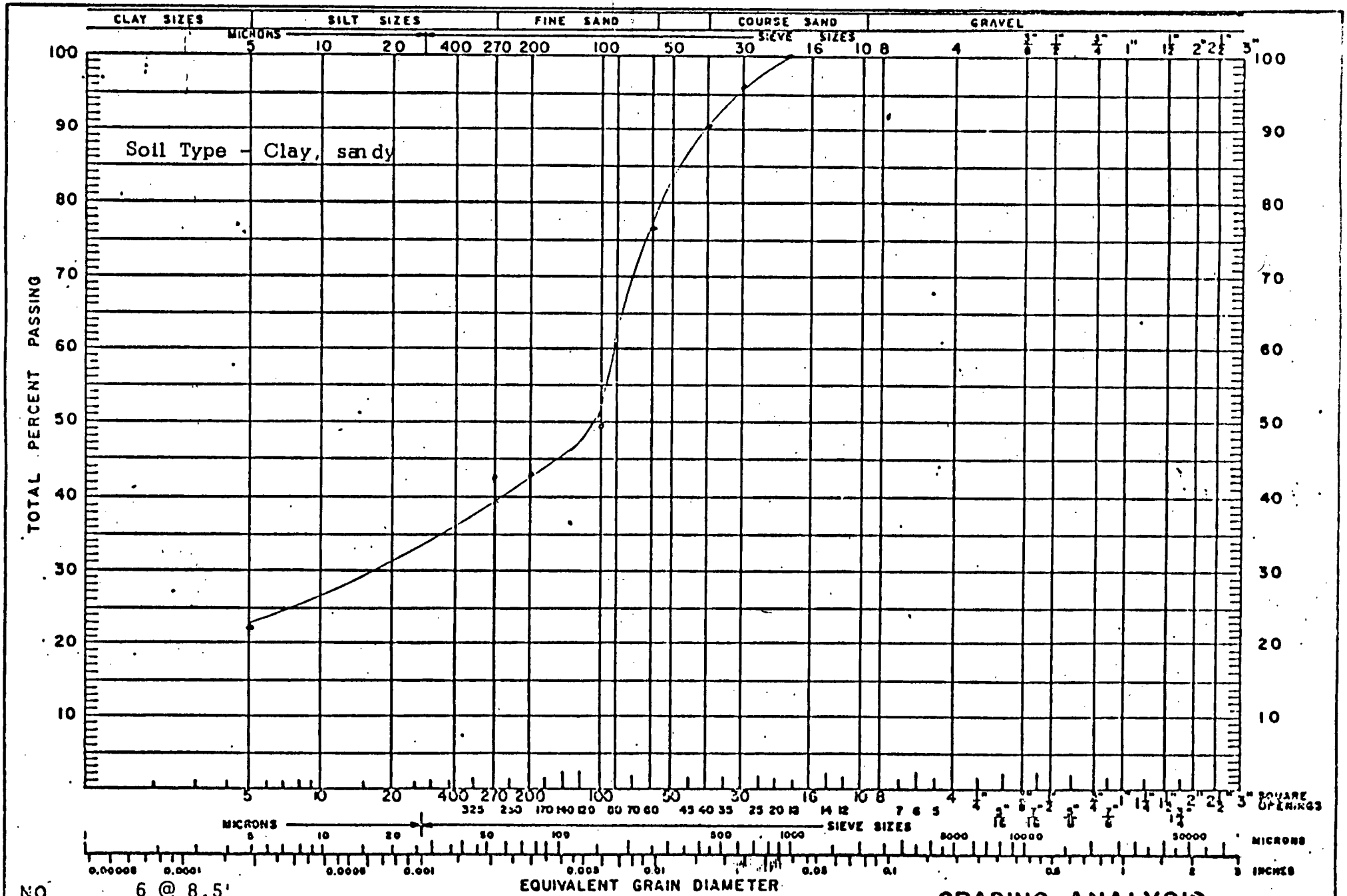
LOCATI(Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 49!

FIGURE NO.

PLATE K



NO. 6 @ 8.5'

DATE 9/11/72 BY C.W.

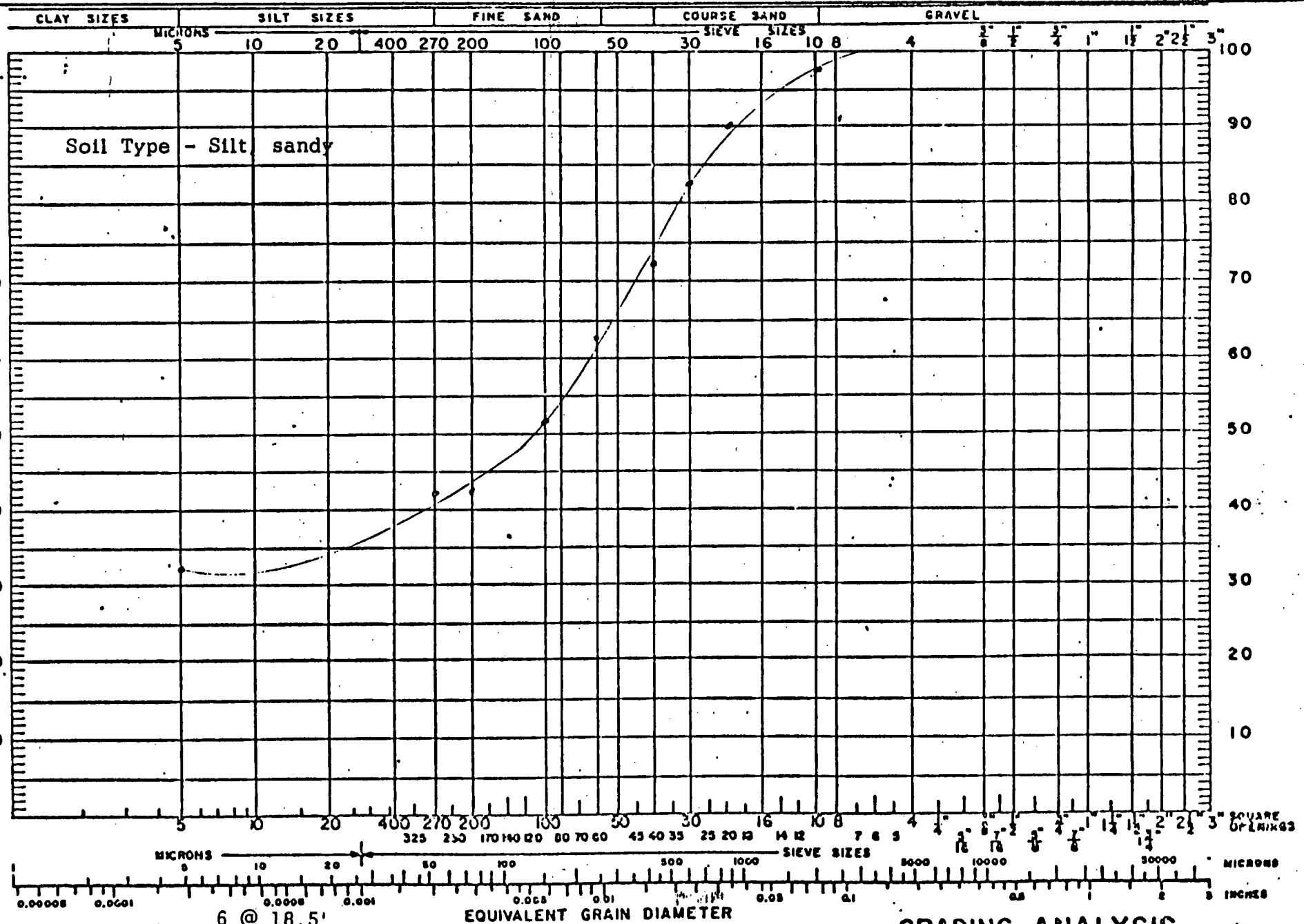
LOCATIO Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO 4995

FIGURE NO.

PLATE L



NO. 6 @ 18.5'

DATE 9/11/72 BY C.W.

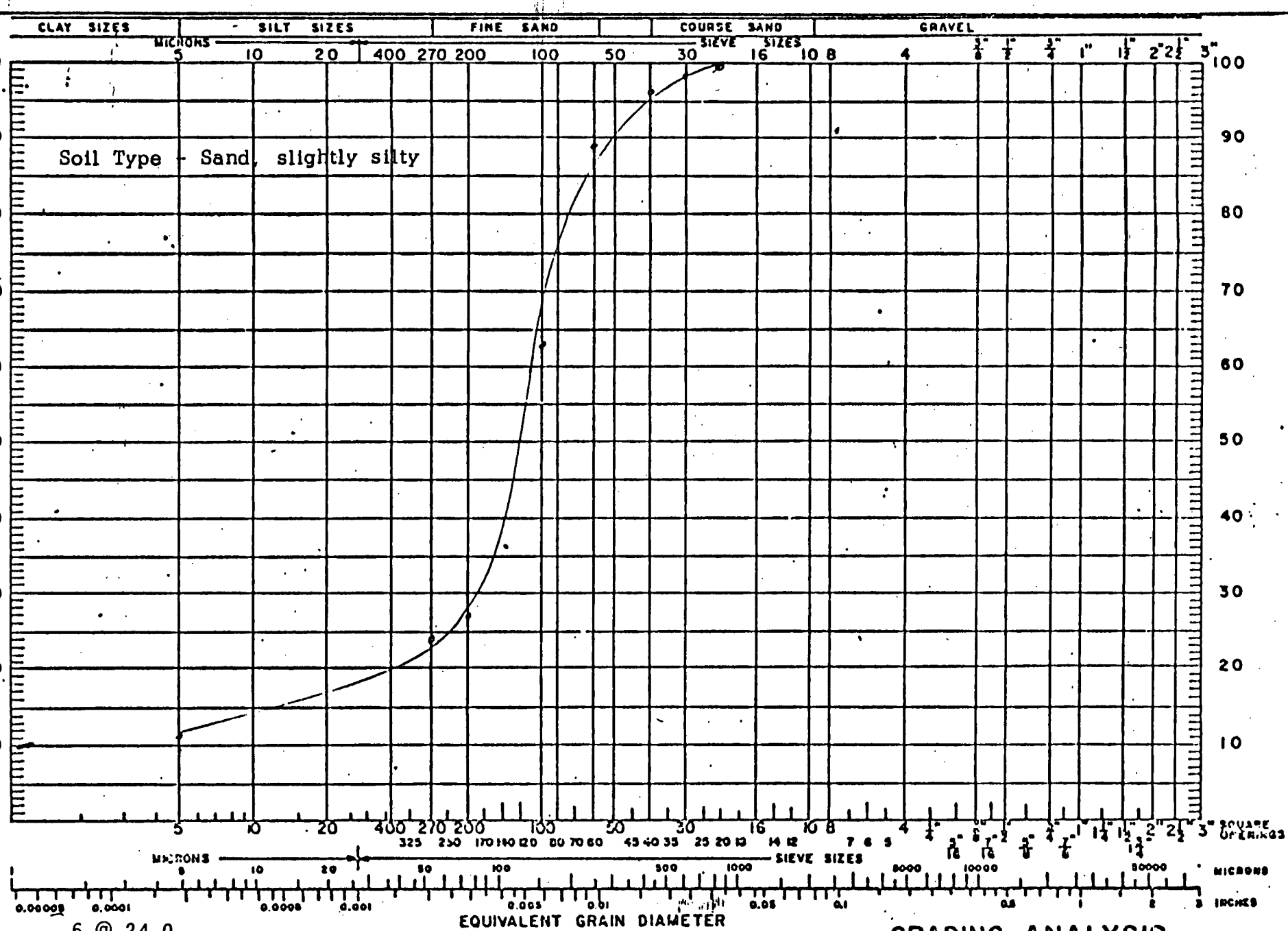
LOCATI(Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 499

FIGURE NO.

PLATE M



NO. 6 @ 24.0

DATE 9/11/72 BY C.W.

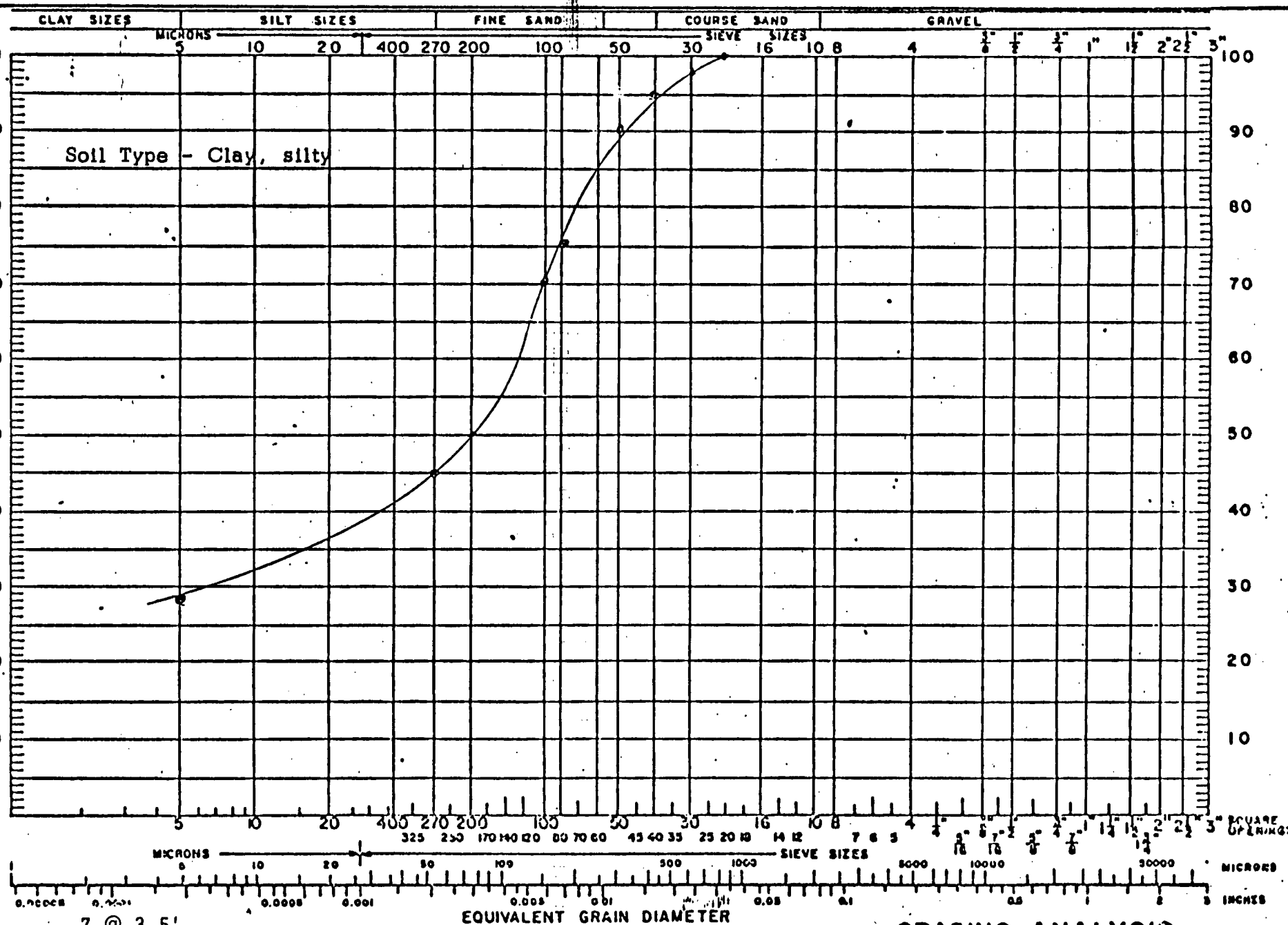
LOCATI(Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4999

FIGURE NO.

PLATE N



NO. 7 @ 3.5'

DATE 9/11/72 BY C.W.

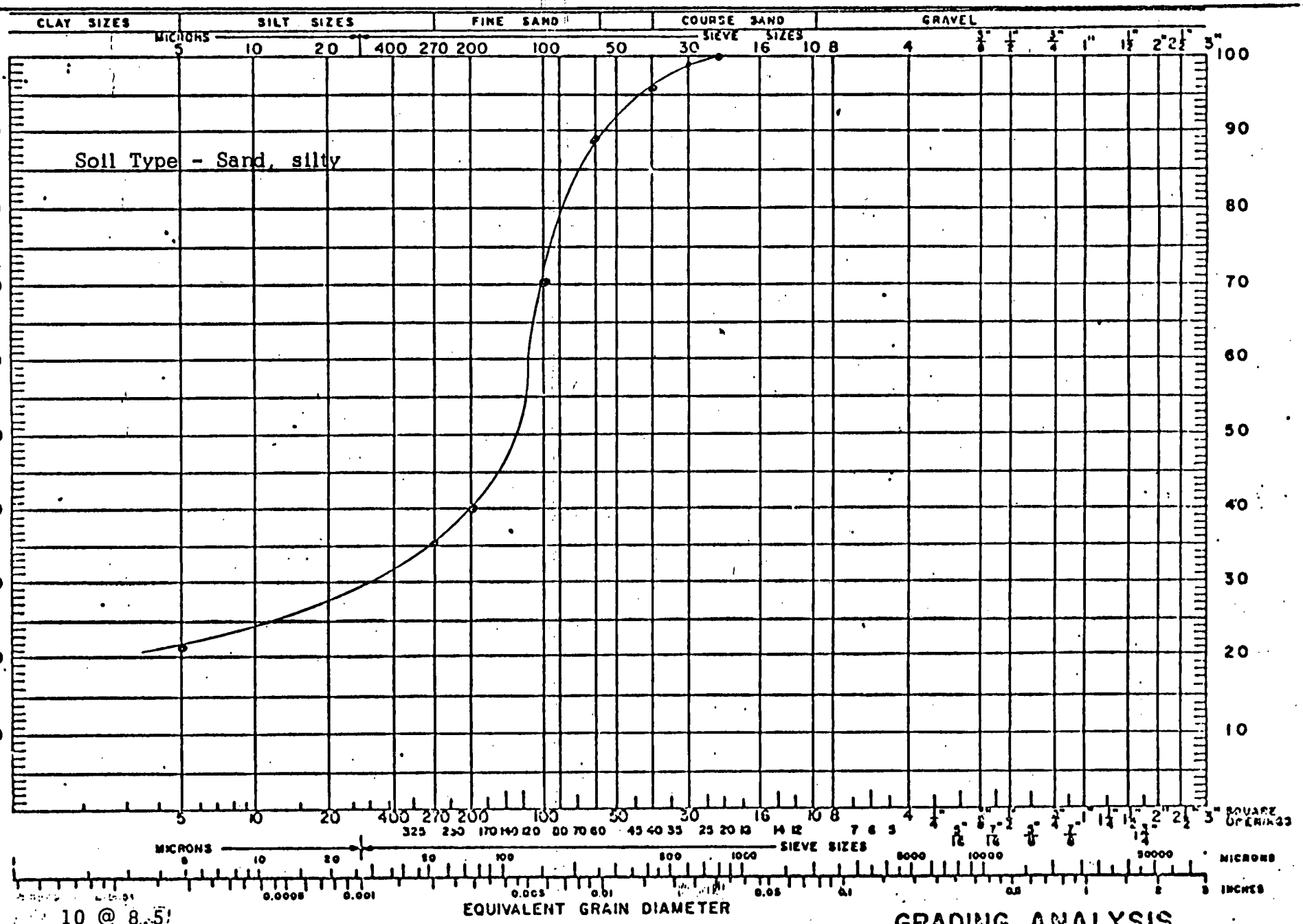
LOCATIO Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 499

FIGURE NO.

PLATE O



NO. 10 @ 8.5'

DATE 9/11 '72 BY C.W.

LOCATIO Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4999

FIGURE NO.

[redacted]

0639-2335

Attachment 2

Preliminary Soils Investigation

Proposed Industrial Development

Del Amo Boulevard

Between Vermont & Normandie Avenues

Los Angeles, California

slidden engineering

Preliminary Soils Investigation

Proposed Industrial Development

Del Amo Boulevard

Between Vermont & Normandie Avenues

Los Angeles, California

September 18, 1979

General

The purpose of this investigation was to determine the characteristics of the subsurface soils on the site so that preliminary building site layouts can be selected based on economic considerations and safe and economical building foundations can be designed. An industrial development has been planned. Single-story, concrete tilt-up construction will be utilized and wall loads will be on the order of 3-4 kips per lineal foot. Maximum column loads are not expected to exceed 90 kips. The floor slabs will be placed at or near the level of the existing grade. Parking and storage areas will also be required. It should be noted that this report is preliminary and not intended for firm design purposes. When building locations are ascertained, additional field borings and field and laboratory testing should be performed to provide specific recommendations for founding the proposed structures.

Nine exploratory borings were drilled to depths of between 15 and 40 feet for this investigation. Their approximate locations are shown on the attached sketch. A caisson-type drilling rig with a 20-inch diameter rotary bucket was used to advance the bore holes. Undisturbed and bulk samples of the subsurface soils were obtained for laboratory testing.

Undisturbed samples were obtained by forcing a 2½-inch diameter split barrel sample tube into the soil.

Field dry densities and moisture contents of the soils were determined and are recorded on the attached boring logs. The soils were logged in the field and their classifications checked in the laboratory by mechanical analyses. Representative grain-size accumulation curves are attached to this report. The shear strength and compressibility of the subsurface soils were determined by laboratory tests. These results are shown graphically on the attached direct shear and consolidation-pressure curves. An Expansion Index test was performed on a sample of the upper soil in accordance with UBC Standard No. 29-2.

Site Location and Conditions

The parcel tested is located on the north side of Del Amo Boulevard between Vermont and Normandie Avenues in the City of Los Angeles. A Department of Water & Power easement with high-tension lines and towers parallels the north property line. Oil company, public street and railroad easements exist within the parcel. Soil and debris has been dumped on the site and many piles of trash and sod are present. A large mound of soil exists in the west-central portion. The parcel is within an old oil field area where capped wells, sumps and oil field debris are present. Railroad side tracks exist in the west portion.

Discussion and Recommendations

Soil Conditions

Evidences of artificial fill were seen in each of the test borings. The fill depths at the boring locations ranged from 1 foot to 25 feet found in Boring 6, which was located on top of the existing mound in the west-central portion. The fill soils found in Borings 1 and 2 at the east end of the parcel and in Borings 7, 8 and 9 at the west end of the parcel were generally clean sandy silts and silty clays and ranged from 1 to 2.5 feet in depth. An Expansion Index test on a sample of this upper soil showed an E.I. of 61 and the tested material has a medium expansion potential. Beneath the fills are medium-loose to medium-stiff lean clays with a high expansion potential. Underlying the lean clays are firm clayey silts and silt and fine sand mixtures which extended to the bottoms of the borings. In Borings 3, 4, 5 and 6 located in the east-central and central portions of the lot, the fill materials appeared to be oil field debris and residual bituminous materials mixed with soil. ~~A 1-2-foot cover exists~~ over these fills at most locations and in the ~~west-central portion these fills were found beneath the soil mound~~. The odors from this material were nauseating and stronger than those oily odors encountered on other projects located in oil sumps and oil field areas. The gases causing these naptha-like odors should, of course, be analyzed for toxicity and combustibility if any building construction or removal and recompaction work is planned in this area. The fill materials are oil-soaked soils contaminated with

tar-like materials with some pieces of broken concrete, wood and other organic debris. Beneath the fills are generally medium-firm odoriferous sandy and clayey silts. In Boring 6 these underlying materials contained what appeared to be cemented lenses and the compact and firm materials to a depth of 40 feet showed small bleeding veins of tar like material and the soils had a strong naptha-like odor. The soils found in the mounded area are generally sandy silts and silty clays. At the boring location they were relatively clean, being free of deleterious organic material, although they did have some concentration of broken pieces of concrete and A.C. to 6 inches in maximum size. Such material would be suitable for use as on-site fill. No ground or perched water was encountered. Cross-sections of the on-site soils are shown on the attached boring logs.

General Foundation Design

Based on the preliminary soils work performed to date, the easternly 400 feet and westernly 1000 feet of the parcel appear to contain shallow, relatively clean artificial fills overlying firm natural soils. In these areas the existing fill soil could be removed, reused and recompacted within the building areas and the proposed structures supported on spread footings obtaining bearing in the recompacted on-site soils. Over the balance of the site, the fill materials are deeper, contaminated and odoriferous. In this area the removal and recompaction work within the building areas would be difficult, time-consuming and expensive. In many cases within oil field areas it is possible to remove, spread

and dry oil-soaked soils prior to their reuse when blended in a 1:2 ratio with clean soils. Because of the high concentrations of tar-like material and other debris encountered in some of the tested areas, such drying and blending would not be possible for much of the fill material. In such cases it would be necessary to remove and export this contaminated soil and replace it with clean imported soil. In addition, the adverse effect of the gaseous characteristics should be considered.

Site Preparation and Earthwork

East and West Shallow Fill Areas - Within the proposed building areas and in a 5-foot wide perimeter strip beyond the proposed building walls, at least the upper 2 feet of on-site soil should be removed. Any artificial fill remaining at the bottom of the excavation should also be removed. If fills deeper than 5 feet are encountered, the width of the removed perimeter strip around the building should be increased to equal the depth of fill encountered. Temporary construction cuts in the on-site fills should not be expected to stand at slopes steeper than 1 horizontal to 1 vertical. Where building walls are located at or near easement lines, permission should be obtained from the easement owners to allow for the perimeter overexcavation. The base of the excavation should then be scarified to a depth of 6 inches, brought to near optimum moisture content and compacted to 90% of maximum dry density as determined by test method ASTM D 1557-70. The excavated soil, cleaned of foreign material, can then be reused and should be replaced in 6-inch layers, brought to near optimum moisture content

and compacted to 90% of maximum dry density. Soils containing high concentrations of tar-like material or other debris should be hauled from the site. Oil-soaked soils may be spread, dried and reused if blended with clean approved soil in a ratio of 1 part oil-strained material to 2 parts clean soil. On-site A.C. and concrete if broken into pieces less than 6 inches in maximum size may be incorporated into the compacted fill, but not in 10-foot wide strips along footing lines or within 18 inches of finished grade and should not occupy more than 15% of the fill volume. Import soil should be an approved clean, non-expansive soil type and it should be compacted to 90% of maximum dry density. All wall, footing and utility trench backfill should be compacted to 90% of maximum dry density.

Central Heavy Fill Area - Within the proposed building areas and in a 10-foot wide perimeter strip around the proposed buildings, the existing artificial fill and at least the upper 6 inches of natural soil should be removed. Any soft or saturated materials remaining at the bottom of the excavation should also be removed. The recompaction work should then proceed as previously outlined. Substantially more haul-away would be required in this area - estimated to be on the order of 30%-70% of the fill encountered - and the soft consistency of the fills to be removed together with their odoriferous nature will require special construction and safety procedures.

Paved and Storage Areas - The only way to assure of no future settlements in such areas would be to remove and recompact all of the fill. This

is not economically justifiable. It is therefore recommended that in these areas the upper 2 feet of on-site soil be cleaned of deleterious foreign material and all concrete or A.C. pieces larger than 12 inches and compacted to 90% of maximum dry density. The upper 6 inches of compacted subgrade soil should be free of all foreign material. Some settlements should be expected in these areas and design criteria for drainage and buried utility lines should take this probability into account.

Spread Footings

If the above recommendations are followed, spread footings obtaining bearing in the recompacted soils or underlying natural soils may be used to support the structures. Exterior footings should extend at least 24 inches beneath the exterior finished surface. Isolated square or rectangular footings so placed may be designed using an allowable bearing value of 2500 pounds per square foot. Continuous footings, having the same embedments, may be assigned an allowable bearing value of 2000 pounds per square foot. Continuous footings should be provided horizontal reinforcement consisting of at least two No. 4 bars - one placed at the top of the footing and one at the bottom. No bearing value increases are recommended for increases in footing widths or depths and the bearing values recommended may be increased by 1/3 to resist wind, seismic or other short time loadings. Care should be taken to see that bearing and subgrade soils are not allowed to become saturated from ponding of rain water or from planting area sprinklers.

Drainage from the building pad areas should be rapid and complete. If the proposed building is founded as recommended, calculations show that estimated differential settlements should not exceed 0.25 inch.

Lateral Loads

A coefficient of friction of 0.35 may be assumed between the slabs on grade, the footings and the underlying soils. The passive resistance of compacted or natural soils will equal pressures exerted by a fluid having a density of 250 pounds per cubic foot. Active earth pressures against retaining walls will be equivalent to those pressures exerted by a fluid having a density of 30 pounds per cubic foot.

Slab Subgrades

Some of the upper on-site soil is moderately expansive. Slab subgrades should be underlain by at least 6 inches of approved, non-expansive imported soil. Normally loaded industrial floor slabs should have a minimum thickness of 4 inches and be provided with 6x6-10x10 welded wire fabric. Where moisture-sensitive floor coverings will be installed, it is recommended that a moisture-proof membrane be installed. The membrane should be properly lapped, sealed and covered with a thin layer of rolled and moistened sand for protection during construction.

Conclusion

The above are our opinions and engineering judgments based on field and laboratory soil tests and applied soil mechanics principles. Areas

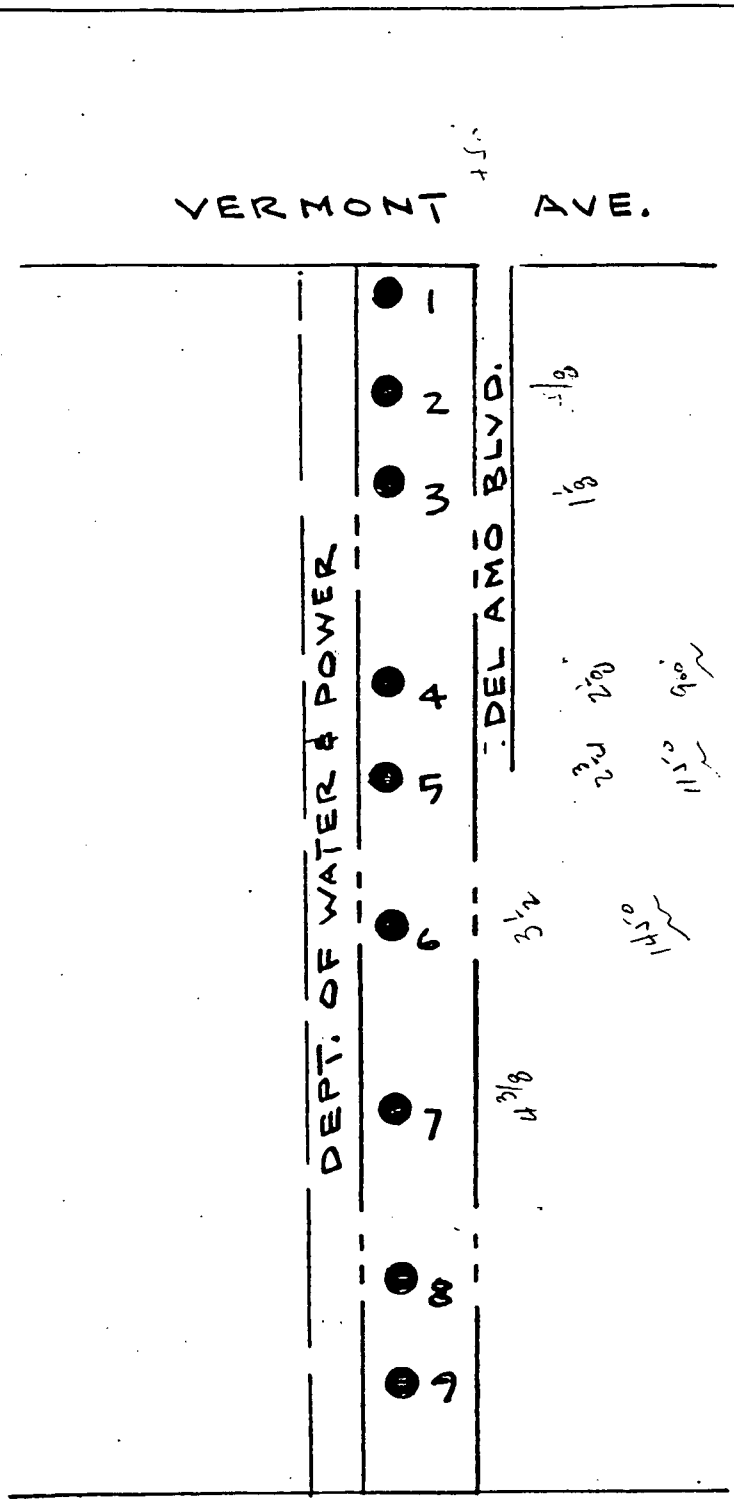
not covered by our test borings are assumed to be consistent with those tested. Following selection of building locations and prior to final foundation design, additional test borings should be performed within the proposed building areas to either confirm or modify the recommendations contained herein. In addition, the characteristics of the gaseous material must be determined prior to design or recompaction work within the central fill areas.

Respectfully submitted,

Sladden Engineering

Jerome H. Fadden CE

JHF:ad



LOCATION PLAN

SCALE: 1"=400'

● APPROX. LOCATIONS - TEST BORINGS

FILE: 444-9184

shilden engineering

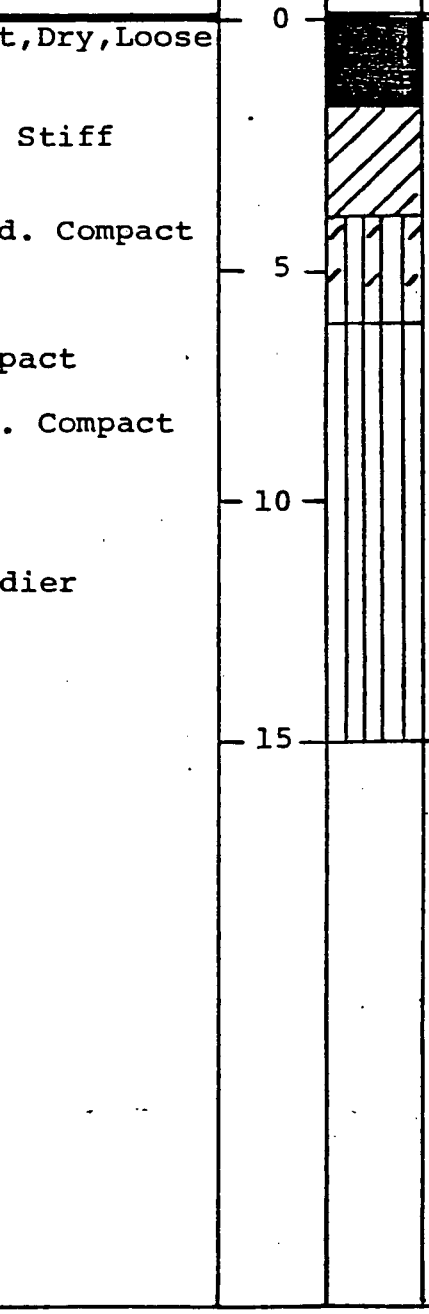
BORING LOG

BORING NO. 1

PROJECT: Vermont & Normandie

DATE: 9-18-79

SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO.	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill, Sandy Silt, Dry, Loose	0				
Lean Clay, Dk. Brown, Med. Stiff			1	112	16
Brown					
Clayey Silt, Lt. Brown, Med. Compact	5				
Sandy Silt, Lt. Brown, Compact			2	115	14
Med. Compact	10				
Sandier	15				



BORING LOG

BORING NO. 2

PROJECT: Vermont & Normandie

DATE: 9-18-79

SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO.	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill, Sandy Silt, Dry, Loose	0				
Lean Clay, Dk. Brown, Med. Stiff					
Brown			1	91	23
Clayey Silt, Brown, Med. Compact	5				
Sandy Silt, Lt. Brown, Med. Compact			2	115	14
Sandier	10				
Cemented					
Compact	15				

slidden engineering

BORING LOG

BORING NO. 3

PROJECT: Vermont & Normandie

DATE: 9-18-79

SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill Lean Clay, Brown, Dry, Loose Concrete Pieces Grey-Tan Strong Naptha Odor	0		1	91	23
Lean Clay, Grey, Med. Stiff	5				
Clayey Silt, Grey-Brown, Med. Compact					
Sandy Silt, Lt. Brown, Med. Compact	10		2	118	14
Cemented	15				

BORING LOG

BORING NO. 4

PROJECT: Vermont & Normandie

DATE: 9-18-79

SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO.	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill Sandy Silt, Grey, Loose Black, Bituminous Strong Naptha Odor Soft, Some Clay	0 5		1	97	24
Clayey Silt, Grey, Med. Compact Odoriferous Sandy Silt, Lt. Brown, Med. Compact Odoriferous Silty Sand, Lt. Brown, Med. Compact	10		2	116	16
Sandy Silt, Lt. Brown, Med. Compact Odoriferous	15				

BORING LOG

BORING NO. 5

PROJECT: Vermont & Normandie

DATE: 9-18-79

SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO.	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill Sandy Silt, Dk. Brown, Loose Some Clay Naptha Odor	0				
	5		1	106	18
Dk. Grey Some Organic					
Lean Clay, Dk. Grey, Med. Stiff Odoriferous					
Clayey Silt, Brown, Med. Compact Odoriferous	10		2	112	18
Sandy Silt, Brown, Med. Compact Odoriferous Tar Veins					
	15				

BORING LOG

BORING NO. 6

PROJECT: Vermont & Normandie

DATE: 9-18-79

SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO.	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill - Mound Area Sandy Silt, Brown, Loose Some Clay	0				
Pieces of A.C. & Conc. to 6"	5		1	90	9
More Clay	10				
Artificial Fill Lean Clay, Black, Soft Heavy Naptha Odor	15				
Bituminous					
Rags	20				
Dk. Brown					
Sandy Silt, Brown, Med. Compact Odoriferous	25				
Cemented Layer	30		2	111	16
Tar Veins					
Odoriferous	35				
	40		3	110	14

slidden engineering

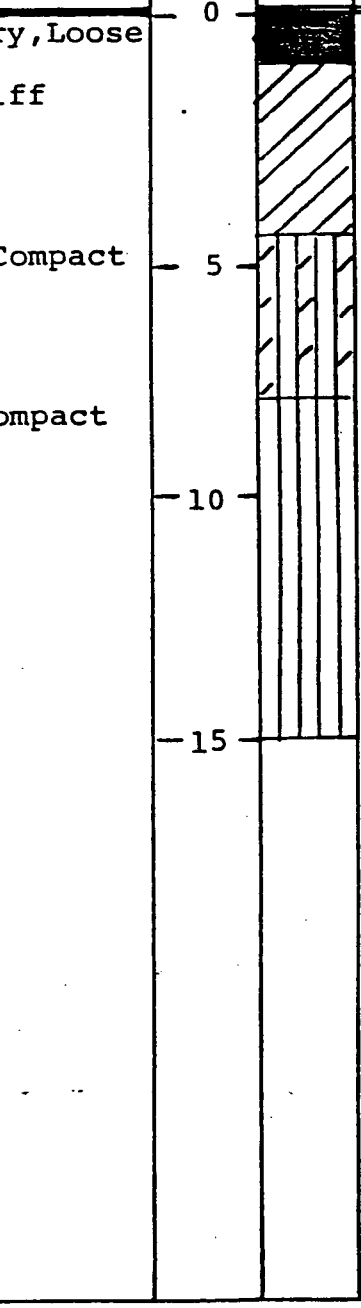
BORING LOG

BORING NO. 7

PROJECT: Vermont & Normandie

DATE: 9-18-79

SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO.	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill, Sandy Silt, Dry, Loose	0				
Lean Clay, Dk. Brown, Med. Stiff					
Brown			1	106	16
Clayey Silt, Lt. Brown, Med. Compact	5				
Sandy Silt, Lt. Brown, Med. Compact					
Sandier	10				
	15				



BORING LOG

BORING NO. 8

PROJECT: Vermont & Normandie

DATE: 9-18-79

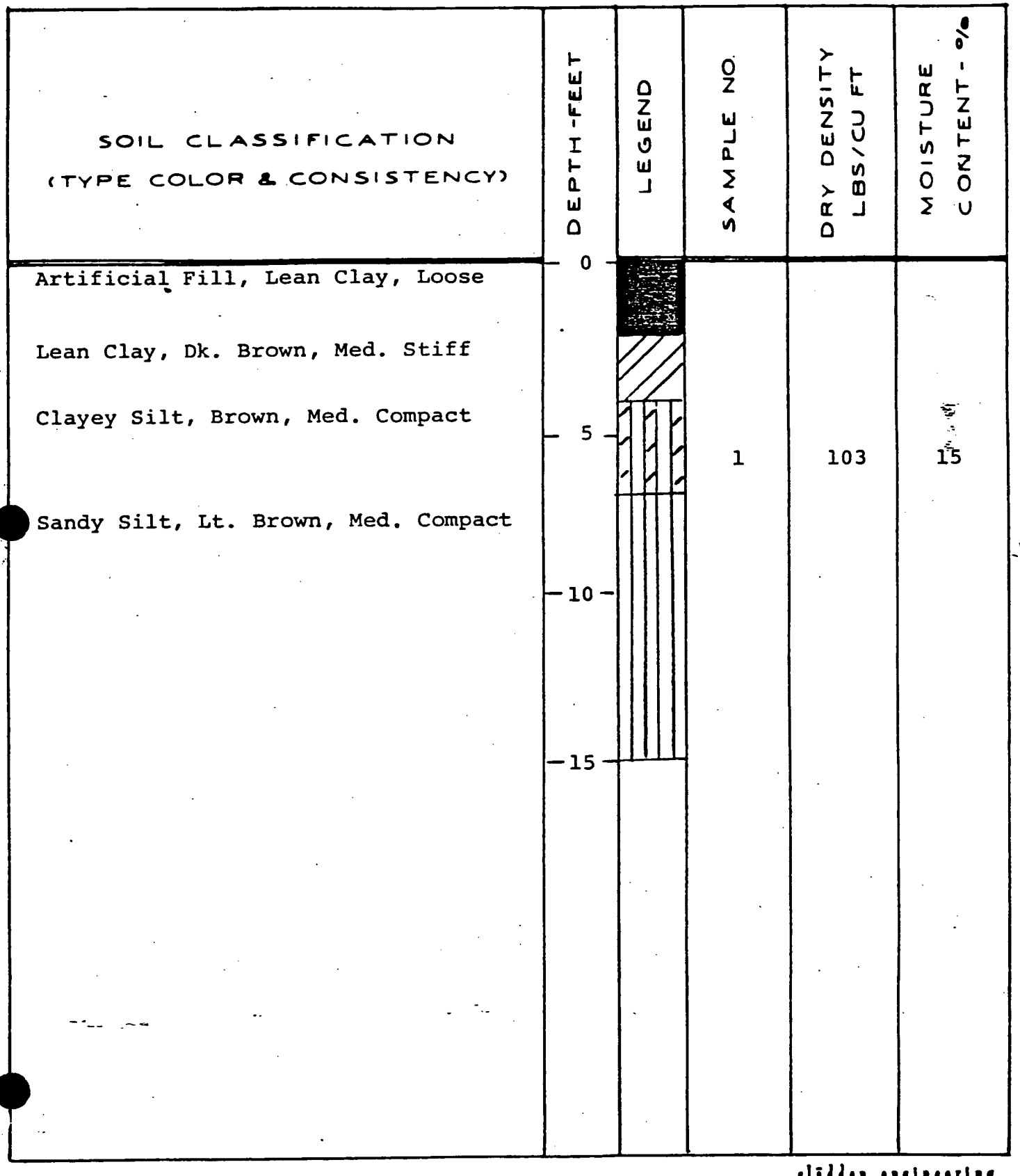
SOIL CLASSIFICATION (TYPE COLOR & CONSISTENCY)	DEPTH-FEET	LEGEND	SAMPLE NO.	DRY DENSITY LBS/CU FT	MOISTURE CONTENT - %
Artificial Fill, Lean Clay, Loose Trace of Gravel	0				
Lean Clay, Dk. Brown, Med. Stiff					
	5		1	115	14
Clayey Silt, Brown, Med. Compact					
Sandy Silt, Lt. Brown, Med. Compact					
	10				
Silty Fine Sand, Lt. Brown, Med.Comp.					
Sandy Silt, Lt. Brown, Med. Compact Some Clay			2	105	20
	15				

BORING LOG

BORING NO. 9

PROJECT: Vermont & Normandie

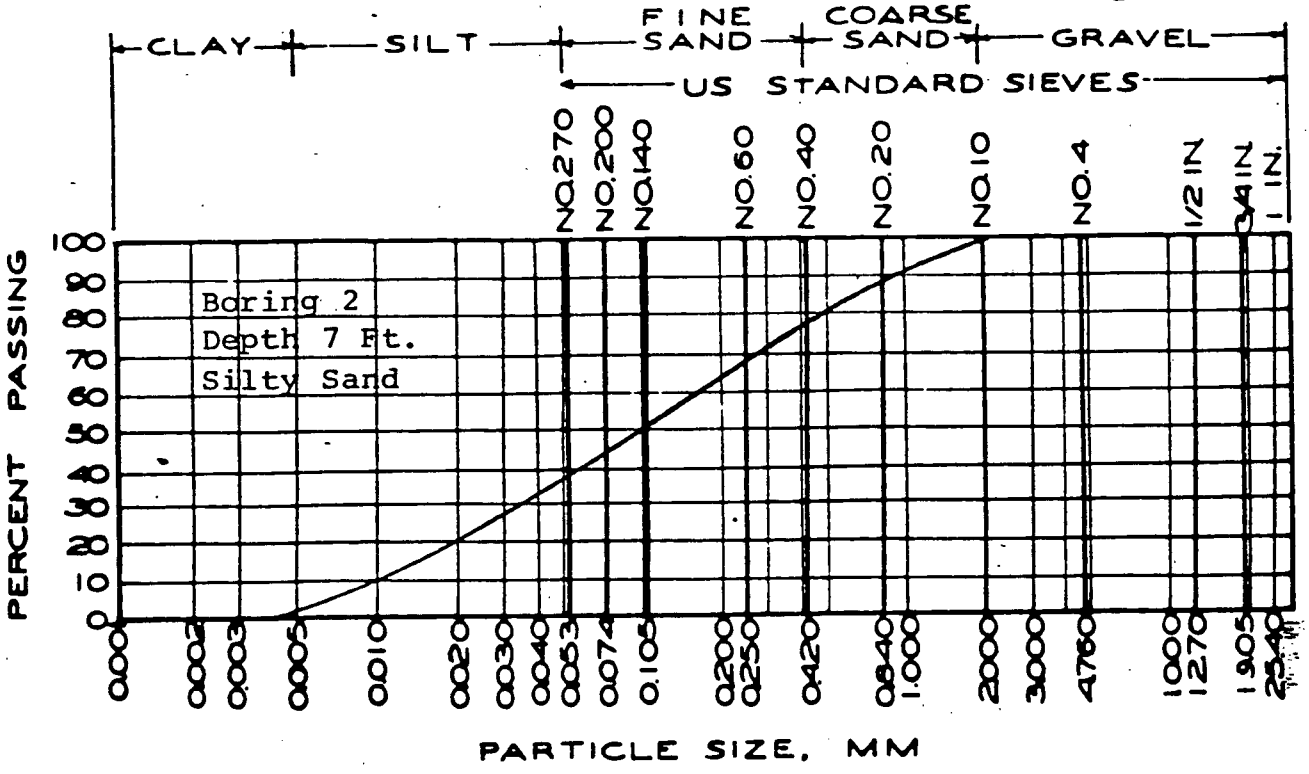
DATE: 9-18-79

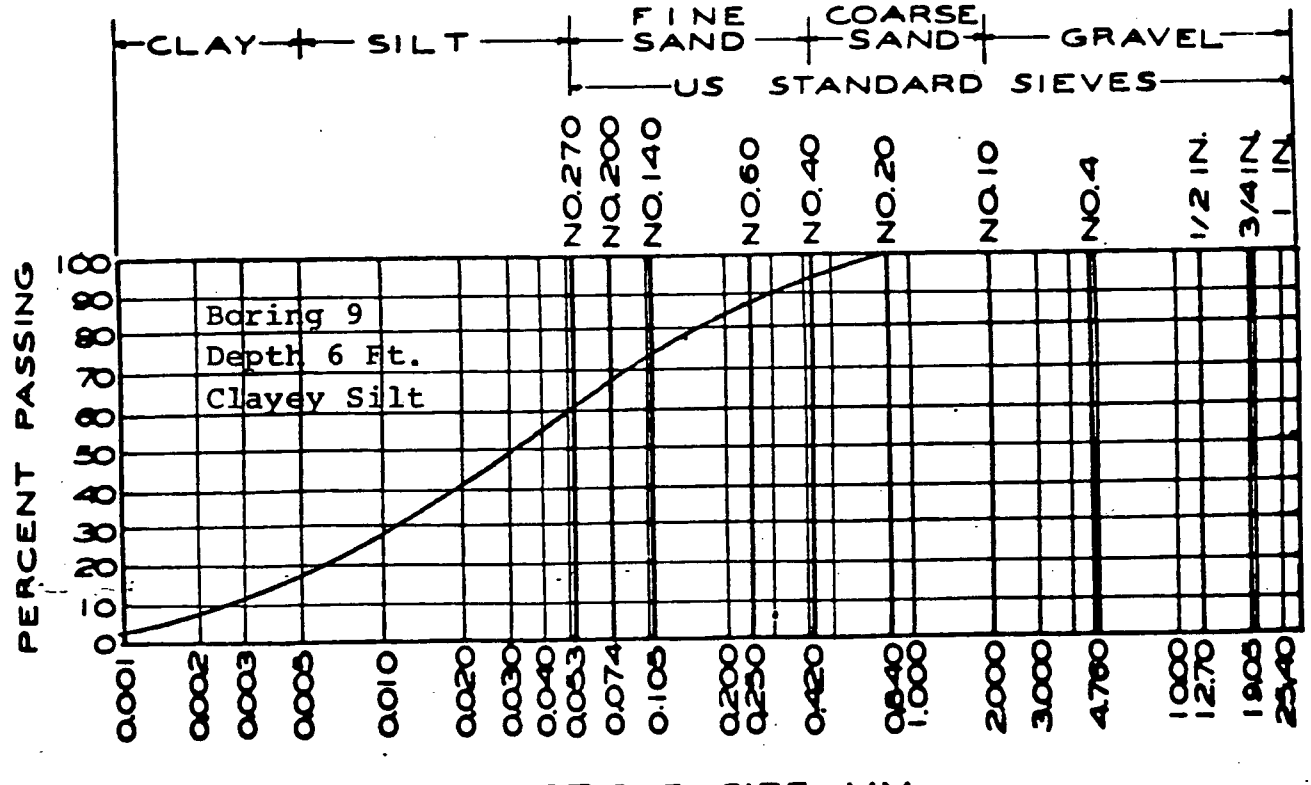


sladden engineering

GRAIN SIZE, MM
ACCUMULATION CURVE

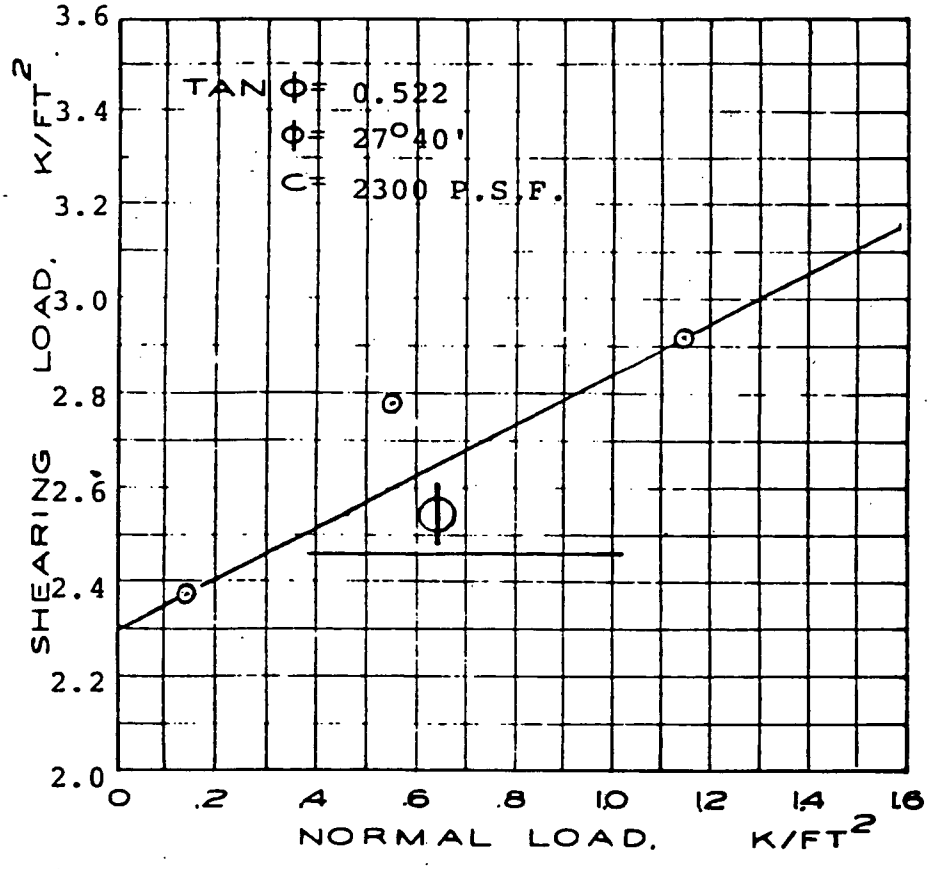
DATE: 9-18-79



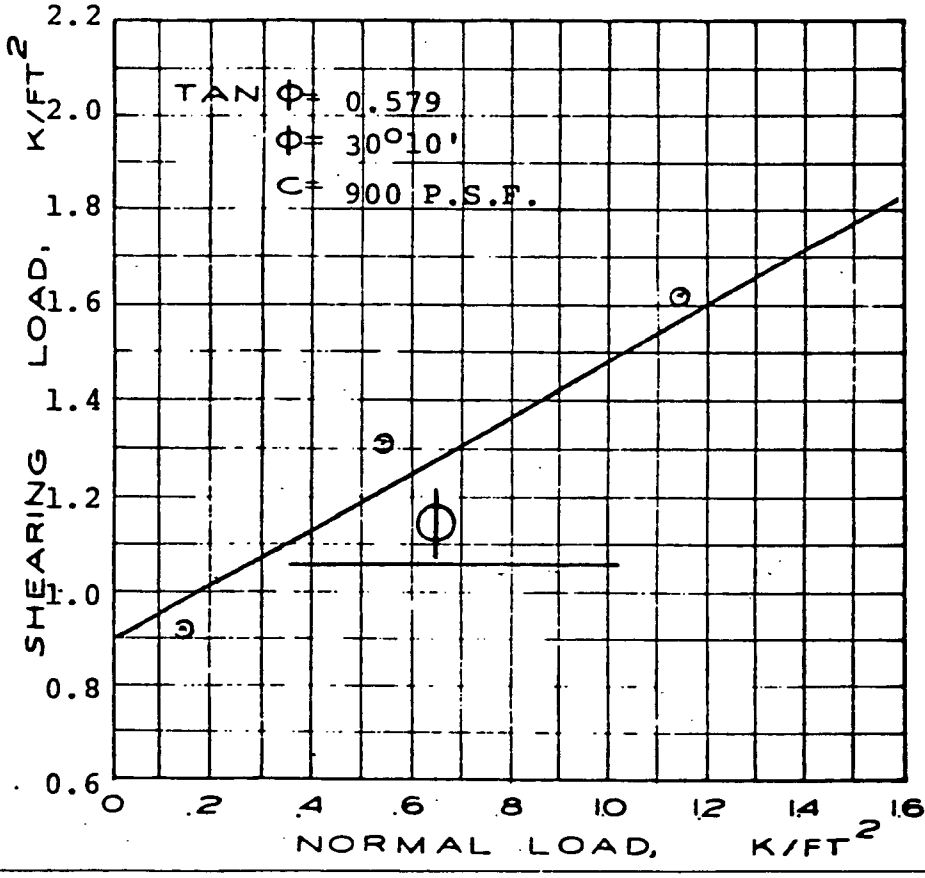


DIRECT SHEAR TESTS

DATE: 9-18-79



BORING NO. 1
SAMPLE NO. 1
DEPTH 2 Ft.

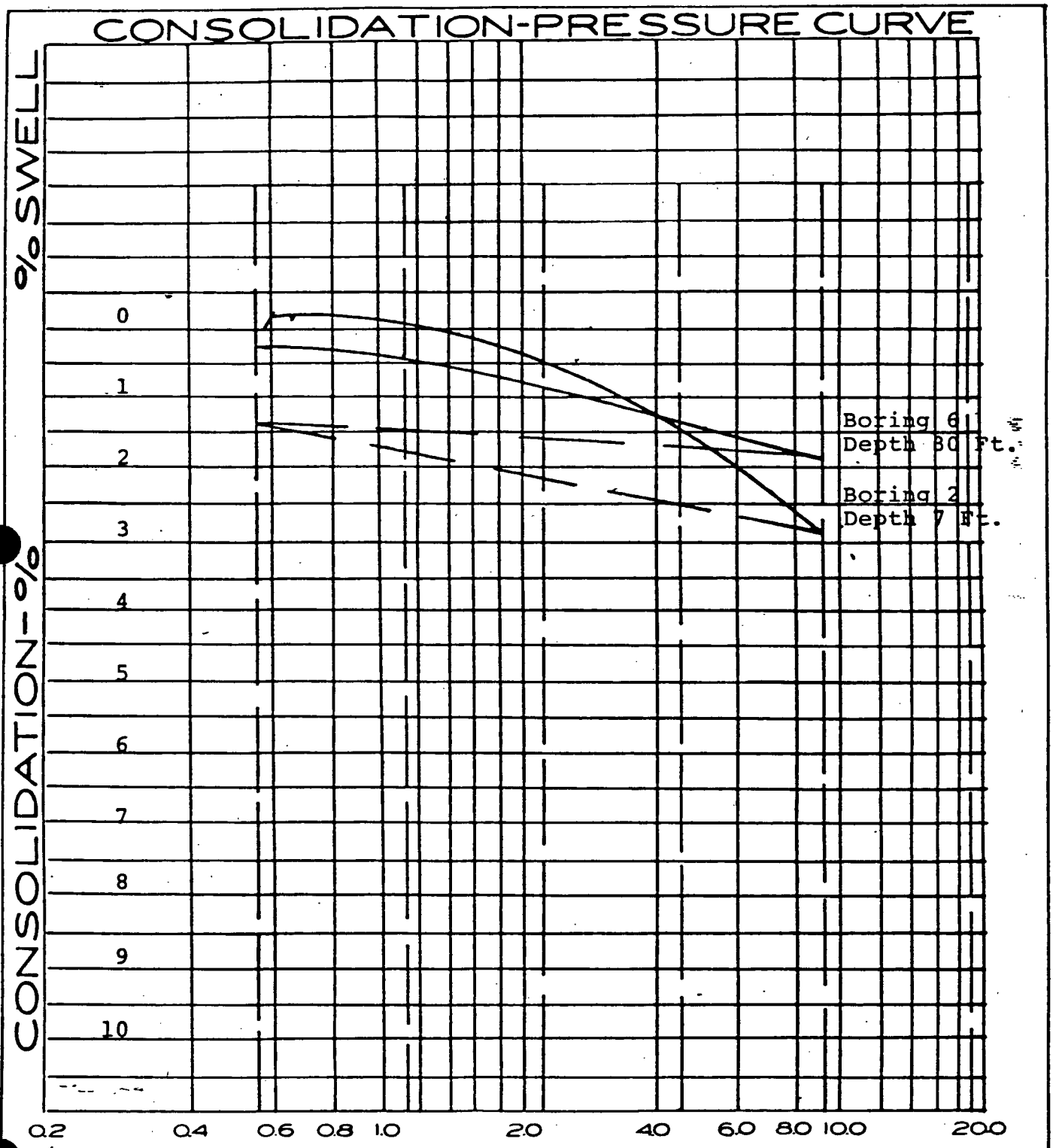


BORING NO. 8
SAMPLE NO. 2
DEPTH 15 Ft.

BORING NO. 2 & 6

DEPTH 7 & 30 Ft.

DATE: 9-18-79



Note: Samples Saturated @ Equiv. Bearing Load of 575 P.S.F.

NORMAL LOAD
KIPS PER SQ. FT.

sladden engineering

0639-2335

[redacted]

Attachment 3

...FORNIA—HEALTH AND WELFARE AG...
...MENT OF HEALTH SERV...ES
...ROADWAY, ROOM 7138
...S CA 90012
...380

GEORGE DEUKMEJIAN, Governor

July 19, 1983

Peter Bloomer
Cabot, Cabot & Forbes
Torrance Properties Inc.
19700 South Vermont
Torrance, California 90502

Dear Mr. Bloomer:

CHARACTERIZATION OF FORMER SHELL CHEMICAL PLANT SITE
SUSPECTED DISPOSAL OF HAZARDOUS WASTES

This is to confirm the June 13, 1983 discussions between Roy Thielking of my staff and Messrs Robert E. Pyers of your company and Jim Sapp of Pacific Soils Engineering, Inc., during an inspection of your property between Vermont and Hamilton Streets and north of Del Amo Boulevard, Los Angels, vicinity of Torrance, California, and the subsequent telecon between Roy Thielking and yourself.

Review of aerial photographs and other available data relative to the former Shell Oil/Shell Chemical Company istes in Torrance indicate that hazardous wastes may have been disposed of on your property.

Ken O'Brien & Associates Engineering report dated September 22, 1982, prepared for Cabot, Cabot & Forbes disclosed that log of Borings Nos. 8,9, and 10 described oassy and odorous materials at depths of 18 to 60 feet. The plan locations of Borings Nos. 9, 10, and 11 cannot be determined from the drawings that accompany our copy of that report.

Aerial photos dated June 17, 1947, July 15, 1956, and September 22, 1965, disclose an oil storage tank surrounded by a dike which occupied the area of your Lot No. 61, which lot, by your account, was recently exvavated to a depth of 14 feet and re-graded with clean soil.

Pursuant to Sections 25220 and 25221 Article 11, Chapter 6.5, Division 20, California Health and Safety Code (copy attached) staff of this Department has reason to believe that your property may be a hazardous waste property as defined in Section 25117.3 of the Code.

3A
Welch
7-31-90

131 EXHIBIT 6

In order that these issues may be discussed more fully, it is requested that you contact Roy Thielking of my staff so that a meeting among the interested parties may be convened at a time and place of mutual convenience.

Sincerely,

for Miller E. Chambers

John A. Hinton, P.E.
Regional Administrator
Southern Region
Permits, Surveillance and
Enforcement Section
Hazardous Waste Management Branch

cc: Department of Health Services, OPPD
Attn: Kent Stoddard

California Regional Water Quality Control Board, Los Angeles Region

Enclosure

CABOT, CABOT & FORBES
911 WILSHIRE BOULEVARD, SUITE 1010, LOS ANGELES, CALIFORNIA 90017

EDWARD J. BALL, JR.

(AREA CODE 213) 626-8171

August 25, 1983

Mr. John A. Hinton, P.E.
Regional Administrator
STATE OF CALIFORNIA
Department of Health Services
Hazardous Waste Management Branch
107 South Broadway, Room 7128
Los Angeles, California 90012

Dear John:

Attached is the summary you requested of the test results IT ANALYTICAL SERVICES prepared from samples obtained from CC&F Torrance Properties, Inc.'s ("CC&F") property in South Bay. The odor panel, boring sample and solid surface sample test results are also attached. Location maps and boring logs have been prepared which indicate the location and elevation of each test.

As we had discussed previously; CC&F purchased the property from Shell Oil in 1972. CC&F held the site for three years until 1975, when we sold it to Golden Eagle Refinery. During this period CC&F did not develop any portion of the site, nor was any dumping or tresspassing allowed. From 1975 to 1982 Golden Eagle owned the site. During this period no dumping took place and no development was undertaken. In 1982 CC&F repurchased the site and commenced demolition and grading during the last quarter of 1982.

Prior to commencing work CC&F retained Royce Donkle. Royces' first job out of college in 1942 was with Shell Oil on this site. The plant was still under construction and Royce personally observed much of the new construction. Royce worked on the site until Shell closed the plant, at which time he retired and became a consultant to Cadillac Fairview and CC&F.

Royce has indicated to you and CC&F that hazardous wastes were not disposed of on this site. He did indicate that a war time dump site was located west of Vermont and immediately north of Del Amo Boulevard (Cadillac-Fairview site). The site Royce is referring to is listed with the State as a Hazardous Waste Site.

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During the grading operation CC&F became aware of an area that contained odoriferous soils. On July 15, 1983 CC&F stopped all work in this area and retained IT ANALYTICAL SERVICES to characterize the soil for any hazardous wastes. Those test results and their respective locations are attached. IT ANALYTICAL SERVICES assured CC&F that: 1) The compounds found in the soil were not regulated by the State or the Federal Government. 2) The concentrations of the compounds were extremely low and almost undetectable. The odors that were being emmitted from the soils were due to the volatile nature of the chemicals that were present. These chemicals, although of low concentrations, were alcohol based and once exposed, evaporated within a matter of hours. IT ANALYTICAL SERVICES assured CC&F that the odorous conditions were not caused by priority pollutants or regulated compounds.

CC&F continued grading and mixing the soil. Based on our discussions with you and your staff, CC&F decided, on a voluntary basis, to take additional tests in the area. On July 1, 1983 four borings were taken on the site. All the borings indicated no extractable semi-volatile organic compounds within the top 25 feet. The concentrations of the identifiable compounds found 50 feet down were very low.

The tests that IT ANALYTICAL SERVICES performed substantiate Royce Donkle's and CC&F's claims that the site was not and is not now a hazardous waste site.

CC&F has incurred considerable expense in testing fees and time in identifying the odoriferous materials we encountered. We have taken it one step further - we did additional testing in areas your staff suggested. All the testing to date has failed to produce any compounds of concentrations that would be considered hazardous to human health.

Miller Chambers' (Department of Health Services, Hazardous Waste Management Branch) letter of July 19, 1983 indicates that aerial photos disclose an oil storage tank surrounded by a dike. Royce Donkle confirms Mr. Chambers' observation. Royce indicates that a fuel oil tank was located on Lot 61. I am not sure what the significance of a fuel oil tank is - but IT ANALYTICAL SERVICES took samples (Boring #1) from Lot 61 and found no evidence of hazardous wastes.

With regard to the Ken O'Brian & Associates Engineering Report dated September 22, 1982, I am not aware of the O'Brian report. CC&F did retain Pacific Soils Engineering, Inc. to perform Soils Engineering on the site. Pacific Soils Boring No's 9, 11, 21 and 22 found evidence of malodorous conditions. IT ANALYTICAL SERVICES duplicated Boring No's 9, 21 and 22 and found no evidence of hazardous wastes.

EXHIBIT

CC&F has cooperated with Department of Health Services staff and would appreciate your assistance in resolving this matter. Continuing studies and testing of the site might be appropriate if CC&F had uncovered any compounds of sufficient concentrations to be hazardous, but this is not the case. The history of the site and the tests performed to date substantiate CC&F's claim that our site is not a hazard waste site.

John, we would appreciate some assistance in resolving this at the earliest possible time.

I will be calling you to follow up. Thank you for your time and effort.

Sincerely,

Edward J. Ball, Jr.

EJB:lmy

cc: Miller Chambers

IT ANALYTICAL SERVICES

WEST COAST TECHNICAL SERVICE DIVISION
17605 Fabrice Way • Cerritos California 90701 • 213-921-9831

CERTIFICATE OF ANALYSIS

Cabot Cabot & Forbes
611 Wilshire Blvd.
Los Angeles, CA 90017
Attn: Ed Ball

DATE REPORTED August 15, 1983
PROJECT CODE 26938/yks
ORDER NUMBER Verbal

Summary Report of Job Numbers 26554 & 26411

On 15 June 1983 we obtained six surface samples. Three of the samples were analyzed for pH, and oil and grease. The soils were slightly alkaline and contained trace or undetectable levels of oil. The other three samples were analyzed for volatile organics. A variety of non-regulated hydrocarbons were found at levels of oil ~200 ppm. No regulated materials were noted. Details are given in our report, Job Number 26411 (report dated 15 July 1983).

On 1 July 1983 we obtained ten additional boring samples. These were all analyzed for extractable, semi-volatile organic compounds. In eight of the samples, no organics were detected above 0.2 ppm. In one other sample, one unidentifiable compound was detected at approximately 6 ppm. In the remaining sample, four non-regulated aromatic compounds were seen at 0.8 - 10 ppm and some oil (20 ppm) was detected. No regulated materials were noted. Details are given in our report, Job Number 26554 (report dated 25 July 1983).

Two of the boring samples were analyzed by odor panel. The common descriptors are given in the table below. In overall intensity, boring #3-EL-24 was more intense than boring #4-EL-23.5.

Sample	Odor Descriptors
Boring 3-EL-24	Strong, musty, some pungente
Boring 4-EL-23.5	Heavy oxidized petroleums, strong, chemical

Neil E Spingarn

Neil E. Spingarn, Ph.D.
Title Staff Chemist

EXHIBIT 6

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:PORATION

IT ANALYTICAL SERVICES

WEST COAST TECHNICAL SERVICE DIVISION
17605 Fabrica Way · Cerritos, California 90701 · 213-921-9831

CERTIFICATE OF ANALYSIS

Cabot Cabot & Forbes
911 Wilshire Blvd.
Los Angeles, CA 90017
Attn: Ed Ball

DATE REPORTED: July 25, 1983
PROJECT CODE: 26554/yks
ORDER NUMBER: VERBAL

Ten (10) soil samples labeled as follows:

Bore 1 EL-6	Bore 3 EL-1
Bore 1 EL-19	Bore 3 EL-24
Bore 2 EL-3	Bore 4 EL-1.5
Bore 2 EL-17	Bore 4 EL-21.5
Bore 2 EL-28	Bore 4 EL-23.5

The soil samples were analyzed by combined gas chromatography-mass spectroscopy for methylene chloride extracted base/neutral and acid semi-volatile compounds. A 30m by 0.32mm DB5 fused silica capillary column, temperature programmed from 30°C (hold for 4 min) to 300°C at 10°C/min, was utilized for the analyses. The results are listed in Table I.

EXHIBIT 6

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Michael Diday

Michael Diday
Title Senior Chemist

Table I: GC/MS Analysis

Sample	Compound Identification	Concentration (Micrograms/kilogram)
Bore 1 EL-6	No compounds detected	ND<200
Bore 1 EL-19	No compounds detected	ND<200
Bore 2 EL-3	No compounds detected	ND<200
Bore 2 EL-17	No compounds detected	ND<200
Bore 2 EL-28	No compounds detected	ND<200
Bore 3 EL-1	No compounds detected	ND<200
Bore 3 EL-24	Unidentified compound	6000
	Other semivolatile compounds	ND<200
Bore 4 EL-1.5	No compounds detected	ND<200
Bore 4 EL-21.5	No compounds detected	ND<200
Bore 4 EL-23.5	Trimethylnaphthalenes	10000
	Methylphenanthrene	2000
	Dimethylnaphthalenes	1000
	Phenanthrene	800
	C_{10}-C_{14} Aliphatic hydrocarbons	20000
	Other semivolatile compounds	ND<200

ND - This compound was not detected the limit of detection for this analysis is less than the amount stated in the table above.

IT ANALYTICAL SERVICES

WEST COAST TECHNICAL SERVICE DIVISION
17605 Fabrica Way • Cerritos, California 90701 • 213-921-9831

CERTIFICATE OF ANALYSIS

Cahat Cahat & Forbes
c/o Pacific Soils Engr.
611 Wilshire Blvd.
Los Angeles, CA 90017
Attn: Ed Ball

DATE REPORTED: July 15, 1983
PROJECT CODE: 25411/yks
ORDER NUMBER: VERBAL

Six (6) solid samples.

three samples were analyzed for pH and oil/grease content. These results are given in Table I. The other samples were analyzed for volatile organics. These results are in Table II. None of the compounds listed in Table II are specifically regulated as EPA priority pollutant or in the California Assessment Manual.

Table I

Sample	pH	Oil & Grease (mg/kg)
#1, Green sand	7.88	ND 70
#2, Green sand	8.49	ND 70
#3, Clay	7.60	70

Table II. Volatile Organics

Compound	Concentration (ug/g) Brown	Green	Lot 64/SW Corner
C_{12} Branched hydrocarbon	ND 0.005	100	200
C_8 Branched hydrocarbon	ND 0.005	60	70
Dimethylcyclohexane	0.2	50	70
2,4,4-Trimethyl-2-pentene	0.4	50	50
1-Ethyl-2-methyl cyclohexane	ND 0.005	40	50
2-Methyl-2-propanol	0.5	ND 0.5	ND 0.5
2-Methyl-2-butanol	0.1	ND 0.5	ND 0.5
Unidentified compounds	ND 0.005	50	50

ND - This compound was not detected; the limit of detection for this analysis is less than the amount stated in the table above.

Neil E. Spingarn, Ph.D.
Staff Chemist
Title

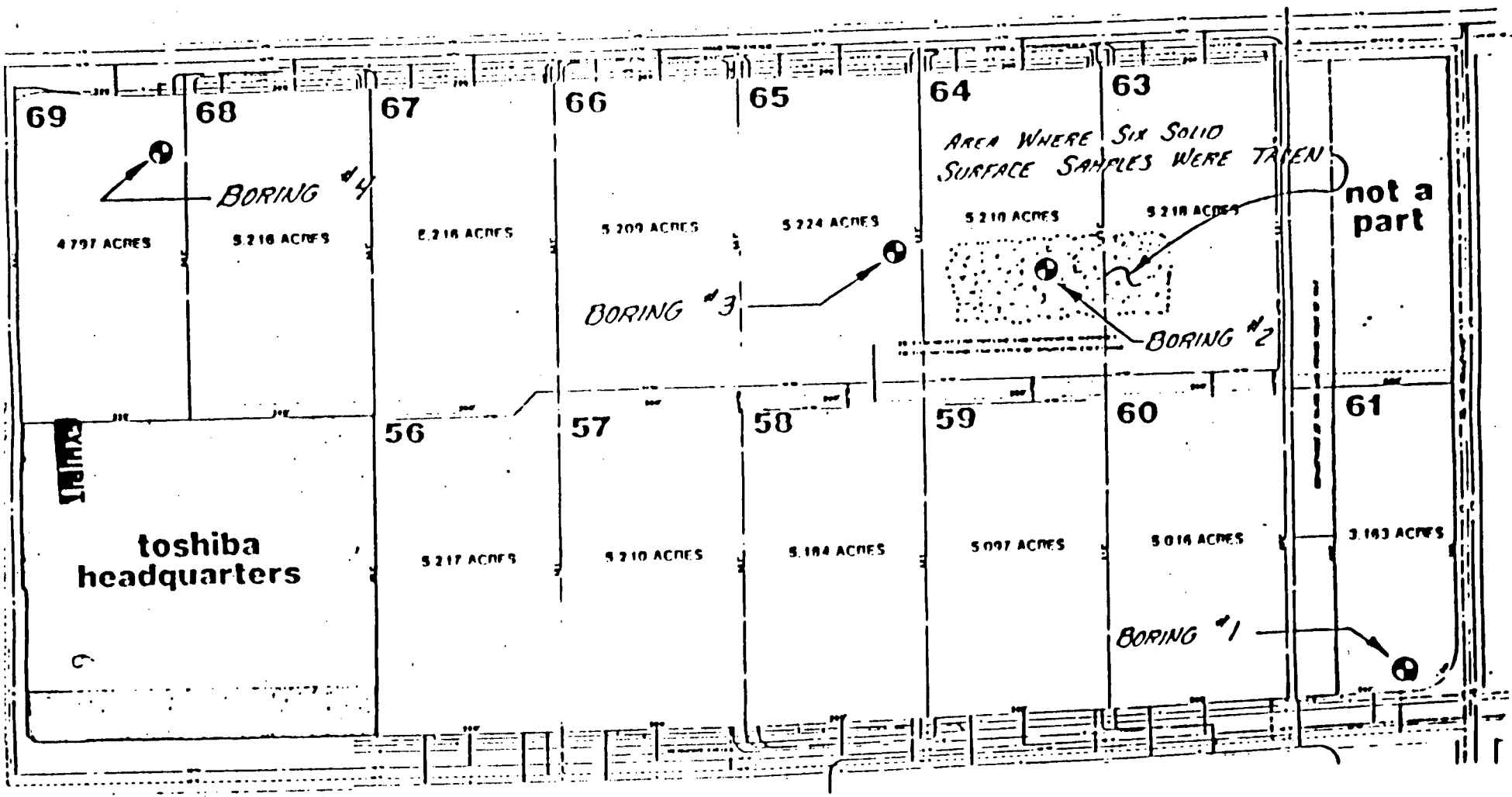
Approved By

EXHIBIT 6

1/10

SURFACE SAMPLES ... TAKEN

ANALYZED FOR CABOT, CABOT & FORBES

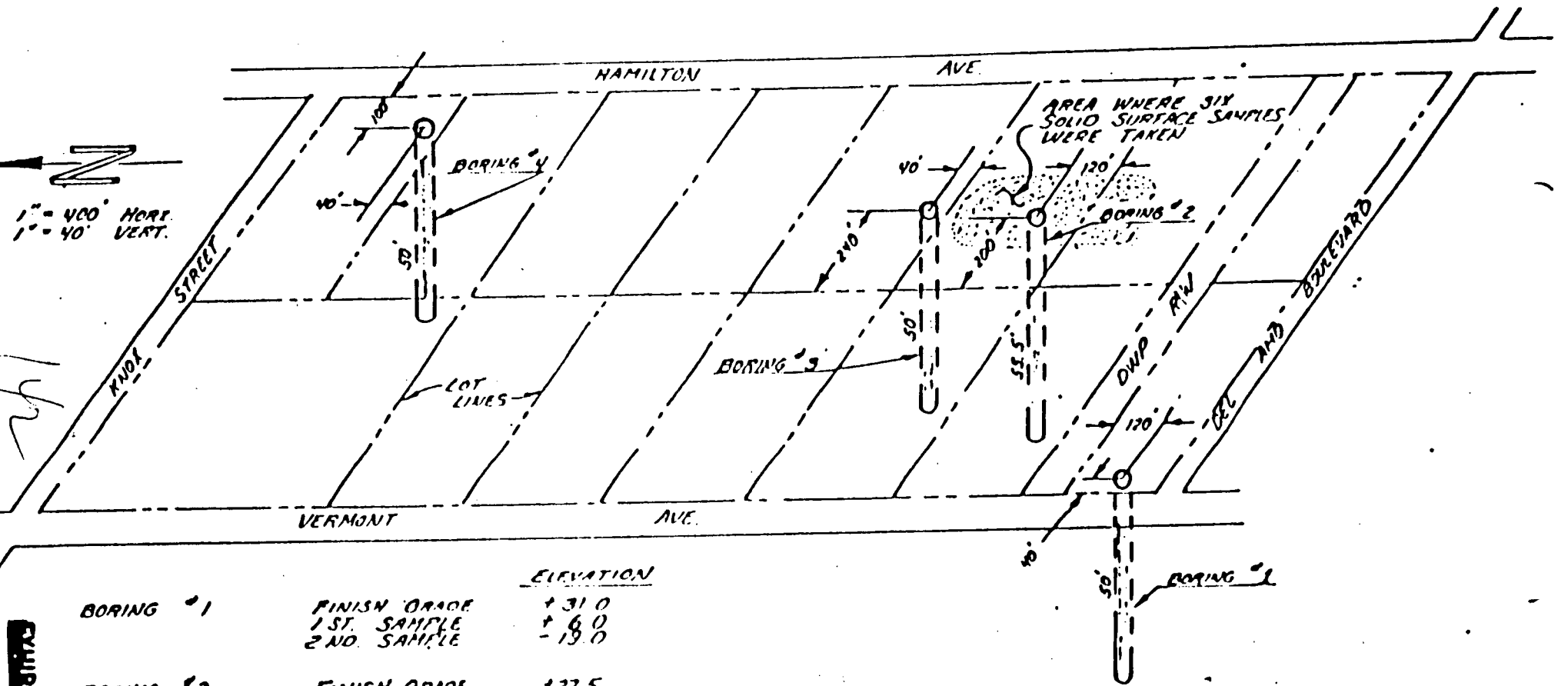


the harbor technology center for cabot, cabot and forbes

lot plan

hill · ckert architect

LOCATION MAP OF BORING SAMPLES AND SURFACE SAMPLES ANALYZED BY IT ANALYTICAL SERVICES

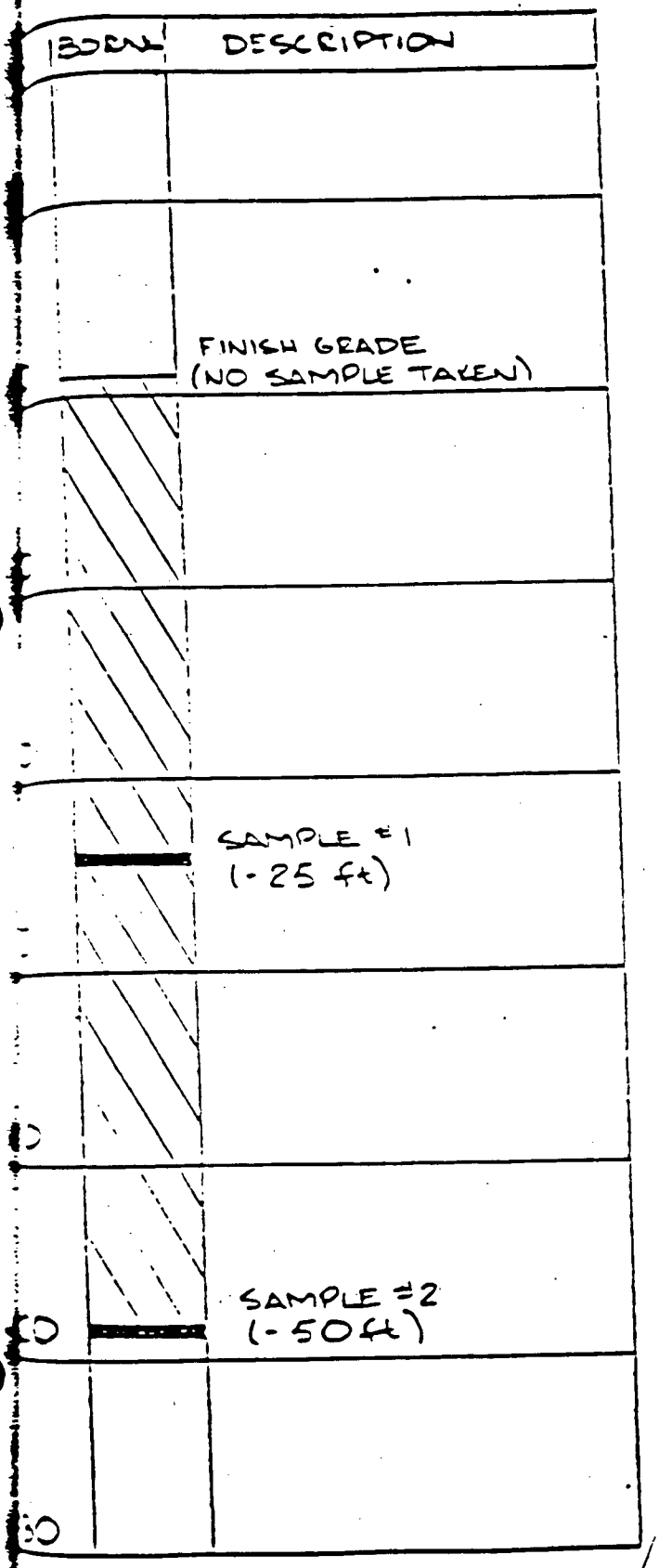


		ELEVATION
BORING #1	FINISH GRADE	+31.0
	1ST. SAMPLE	+6.0
	2 NO. SAMPLE	-19.0
BORING #2	FINISH GRADE	+22.5
	1 ST. SAMPLE	+17.0
	2 NO. SAMPLE	-3.0
	3 RD. SAMPLE	-29.0
BORING #3	FINISH GRADE	+26.0
	1 ST. SAMPLE	+1.0
	2 NO. SAMPLE	-24.0
BORING #4	FINISH GRADE	+26.5
	1 ST. SAMPLE	+21.5
	2 NO. SAMPLE	+1.5
	3 RD. SAMPLE	-23.5
SURFACE SAMPLES		

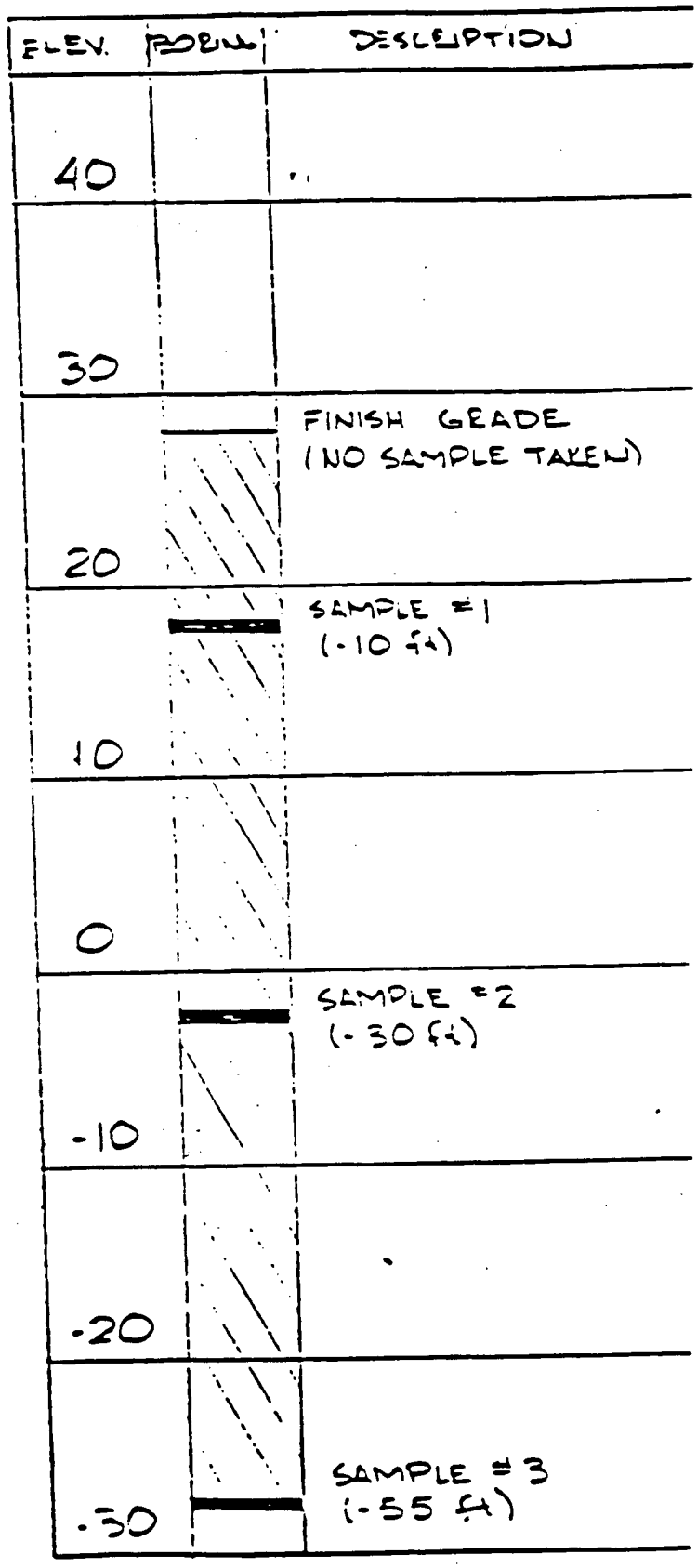
HARBOR TECHNOLOGY CENTER

BORING LOG

BORING NO. 1



BORING NO. 2



1 of 2

EXHIBIT 6

BORING LOG.

BORING NO. 3.

ELEV.	DEPTH	DESCRIPTION
		FINISH GRADE (NO SAMPLE TAKEN)
		SAMPLE #1 (-.25 ft)
	20	
	30	SAMPLE #2 (-.50 ft)

BORING NO. 4.

ELEV.	DEPTH	DESCRIPTION
40		
30		
		FINISH GRADE (NO SAMPLE TAKEN)
20		SAMPLE #1 (-.5 ft)
10		
0		SAMPLE #2 (-.25 ft)
-10		
-20		
-30		SAMPLE #3 (-.50 ft)

CABOT, CABOT & FORBES
911 WILSHIRE BOULEVARD, SUITE 1010, LOS ANGELES, CALIFORNIA 90017

EDWARD J. BALL, JR.

(AREA CODE 213) 626-8171

August 26, 1983

Mr. John A. Hinton, P.E.
Regional Administrator
STATE OF CALIFORNIA
Department of Health Services
107 South Broadway, Room 7128
Los Angeles, California 90012

Dear John:

Attached are the reports that Royce Donkel prepared for CC&F. I think that they are self-explanatory and if you have any questions please feel free to call Royce or myself.

Sincerely,

Edward J. Ball, Jr.

EJB:lmy

Enclosure

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EXHIBIT

August 25, 1983

Cabot, Cabot & Forbes
911 Wilshire Boulevard
Suite 1010
Los Angeles, California 90017

Attention: Mr. Edward J. Ball, Jr.

Gentlemen:

Following is a summary of my work experience on the site of the Harbor Technology Center, and Pacific Gateway Center.

Shell

1943 - 1947	Chemist
(1947 - 1950	Houston)
1950 - 1952	Sr. Chemist
1952 - 1955	Chief Chemist
1955 - 1962	Sr. Process Engineer Polymers
1962 - 1972	Staff Engineer Environmental

CC&F

1972 - 1975	Assistant Project Engineer

CF

1977 - 1982	Advisor

CC&F

1982 - 1983	Advisor

Yours very truly,

Royce Donkel
B.S. Chemistry
University of Wisconsin 1943

August 25, 1983

Cabot, Cabot & Forbes
911 Wilshire Boulevard
Suite 1010
Los Angeles, California 90017

Attention: Mr. Edward J. Ball, Jr.

Gentlemen:

The site of Harbor Technology Center was farmland prior to World War II. As supplies of natural rubber from the far east were cut off with the outbreak of the war, it was decided to immediately establish a government owned synthetic rubber industry. On the West Coast, Shell was selected to manufacture butadiene from refinery gases on the Harbor Technology site; DOW to manufacture styrene on the Pacific Gateway site south of Knox Street, and Goodyear and U.S. Rubber to manufacture styrene-butadiene rubber (SBR) on the Pacific Gateway site north of Knox Street.

Construction of the plants began in 1942 and production began in 1943. The butadiene and SBR units were shut down in 1948, as SBR was then deemed uncompetitive with natural rubber. Sytrene production was continued to satisfy the demand for polystyrene, a large volume plastic.

When the Korean War began in 1950, natural rubber producers were in much the same position as OPEC is today, and prices soared. The butadiene and SBR plants were reopened, and SBR then became an economic replacement for natural rubber.

By 1955, the synthetic rubber industry was solidly in the black, and the government decided to dispose of it to private and corporate investors. Shell then purchased the entire West Coast complex for $30 million and operated it until 1972, when its technology had become obsolete. It was then sold to Cabot, Cabot & Forbes for development into an industrial park.

Butadiene manufacture was similar to the operation of a small oil refinery. LPG hydrocarbons were the feed and product. Byproducts were gaseous or liquid fuels. Chemicals employed were used as solvents in separation processes. Other chemicals were used in water treatment for the boilers and cooling towers of the plant heating and cooling systems. Onsite disposal operations required consisted mainly of wastewater treatment, with oils recovered serving as boiler fuel. Solid wastes, such as catalysts, and slurries, such as water treating sludges, were hauled to an offsite disposal facility of suitable classification.

Yours very truly,

Royce Donkle

...IFORNIA—HEALTH AND WELFARE AGE...
...MENT OF HEALTH SER...CES
...BROADWAY, ROOM 7128
...S, CA 90012
...3380

GEORGE DEUKMEJIAN, Governor

August 26, 1983

Edward J. Ball, Jr.
CABOT, CABOT & FORBES
911 Wilshire Boulevard, Suite 1010
Los Angeles, CA 90017

Dear Mr. Ball:

PROPERTY BETWEEN VERMONT AND HAMILTON STREETS AND NORTH OF DEL AMO BLVD.

Based on the information currently available, and the results of subsurface investigations conducted by IT Analytical, there is no reason to believe that the subject property is a hazardous waste property.

If however, future subsurface exploration or excavation reveal the presence of hazardous wastes, the Department will require appropriate mitigative measures.

Sincerely,

John A. Hinton, P.E.
Regional Administrator
Southern Region
Permits, Surveillance and
Enforcement Section
Hazardous Waste Management Branch

JAH/gd
cc: Lloyd Batham

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CABOT, CABOT & FORBES
911 WILSHIRE BOULEVARD, SUITE 1010, LOS ANGELES, CALIFORNIA 90017

TED TOMASOVICH
VICE PRESIDENT

(AREA CODE 213) 626-8171

August 29, 1983

Mr. Howard Mann
Andrex Development Co.
3000 Ocean Park Blvd., #1004
Santa Monica, California

Re: Harbor Technology Center

Dear Howard:

On July 19, 1983, we received a letter from the Department of Health and Services indicating that the staff had reason to believe that our property was a hazardous waste property. We disagreed vehemently and embarked on a testing program to prove we were right.

On August 26, 1983 we received a letter from John A. Hinton, Regional Administrator of the Southern Region for the Hazardous Waste Management Branch. Mr. Hinton's letter states that "there is no reason to believe that the subject property is a hazardous waste property."

I have enclosed copies of correspondence regarding this issue.

Sincerely,

Ted Tomasovich

Ted Tomasovich
/m

Enc.

cc: M. Rushman
E. Ball
P. Blumer

Exhibit 3
7-31-90

EXHIBIT 6

0639-2335

Attachment 4

12/21/90

L·F 2266

EXECUTIVE SUMMARY

At the request of Graham and James, Levine·Fricke (LF) performed a preliminary subsurface investigation at the Harbor Technology Center located at 20280, 20300 Vermont Street in Torrance, Los Angeles County, California (the Site, Figure 1).

Two pipeline easements, owned by Shell Oil Company and Chevron USA, Inc., traverse the Site on the northern and western boundaries, respectively. Previous soil sampling and analyses performed at an adjacent property detected elevated concentrations of petroleum hydrocarbons and benzene in soils sampled near the northeast corner of the Site.

The objective of the investigation was to evaluate soil and ground-water conditions in the northeast corner of the Site, in the vicinity of previously reported occurrences of hydrocarbons in soils. The investigation included (1) drilling exploratory borings and soil sampling; (2) ground-water sampling; and (3) chemical analysis of soil and ground-water samples.

Chemical analysis of soil samples detected benzene, petroleum hydrocarbons, tert-butanol, ketones, and unidentified hydrocarbon compounds.

Benzene and petroleum hydrocarbons were detected in soils sampled at depths of 30 and 40 feet at concentrations which exceed regulatory action levels. Regulatory levels have not been established for tert-butanol and ketones in soils.

Chemical analysis of a qualitative ground-water "grab" sample detected benzene and toluene at concentrations which exceed regulatory levels. Benzene was detected at a concentration at its solubility level, suggesting the possibility that benzene may be floating on the water table.

Based upon the elevated concentrations of benzene detected in soils and ground water sampled at the Site, it is anticipated that soil and ground-water remediation will be required by regulators.

Additional investigation is needed to further evaluate the distribution of benzene-, tolulene-, and hydrocarbon-affected soil and ground water. The additional investigation will include (1) correlation of available soil and ground-water quality data obtained from the immediate Site vicinity with the results of this investigation; (2) drilling exploratory borings and soil sampling; and (3) monitoring well installation, development, and sampling.

Once the magnitude of the chemically affected soil and ground water has been further evaluated, conceptual remedial options, cost estimates, and strategies can be discussed. A proposal for the additional investigation will be provided under separate cover.

December 21, 1990 L·F 2266

PRELIMINARY SUBSURFACE INVESTIGATION

Harbor Technology Center
Torrance, California

1.0 INTRODUCTION

This report presents the results of a Preliminary Subsurface Investigation conducted by Levine·Fricke (LF) at the Harbor Technology Center located at 20280, 20300 Vermont Street in Torrance, Los Angeles County, California (the Site, Figure 1).

Two pipeline easements, owned by Shell Oil Company and Chevron USA, Inc., traverse the Site on the northern and western boundaries, respectively. Previous soil sampling and analyses performed at an adjacent property detected elevated concentrations of petroleum hydrocarbons and benzene in soils sampled near the northeast corner of the Site.

Graham and James of Los Angeles, California requested that LF perform a preliminary evaluation of soil and ground-water conditions in the northeast corner of the Site. The Scope of Work for the investigation was described in LF's proposal to Graham and James dated November 29, 1990. The field exploration activities at the Site were performed in accordance with LF's Health and Safety Plan (HSP) dated December 7, 1990. The HSP for the Site investigation was prepared, based in part upon data obtained from the adjacent property.

1.2 Objective and Scope of Work

The objective of the investigation was to perform a preliminary evaluation of soil and ground-water quality near the northeast corner of the Site. The results of the investigation were intended to provide Graham and James with data which would indicate whether or not on-Site soils and/or ground water had been affected by compounds detected on adjacent properties. The following Scope of Work was performed to implement the project:

- o drilling of exploratory borings and soil sampling;
- o ground-water sampling; and
- o chemical analysis of soil and ground-water samples.

2.0 BACKGROUND

2.1 Site Description

The Site is located at 20280-20300 Vermont Avenue, northeast of the intersection of Vermont Avenue and Del Amo Boulevard in Torrance, California (Figure 1). The 3±-acre Site is developed with two 2-story office buildings with appurtenant asphalt paving and landscaped areas. The Site is bounded on the east by a commercial development located at 20221 Hamilton Avenue. This property is owned by Hamilton Dutch Investors (HDI) and developed with an office-type building and asphalt pavements. Both the Site and the HDI site is bounded on the north by a greenbelt area maintained by the Los Angeles Department of Water and Power (DWP). A pipeline easement owned by Shell Oil Company is located on the northern Site boundary as shown in Figure 2. This easement contains several subsurface pipelines including those for benzene, fuel oil, and other products (EMCON, 1989).

Several exploratory borings have been drilled adjacent to the pipeline easement at the locations shown in Figure 2. The borings were backfilled at the surface with a cement slurry. Details regarding these exploratory borings are not currently known by Levine·Fricke.

2.2 Soils Investigations Performed at 20221 Hamilton Avenue

Subsurface investigations have been performed at the adjacent HDI site by ERT of Irvine, California and by EMCON Associates (EMCON) of Laguna Hills, California. Graham and James provided LF with copies of the ERT and EMCON reports dated August 1988 and March 1989, respectively.

The August 1988 ERT report indicates that soil analyses detected total petroleum hydrocarbons (TPH) and benzene at concentrations of 2,632 parts per million (ppm) and 3.14 ppm, respectively, for soils sampled near the northwest corner of the HDI site at a depth of 15 feet below grade.

The March 1989 EMCON report indicates that soil analyses detected benzene at a concentration of 11.7 ppm for soils sampled near the northwest corner of the HDI site at a depth of 45 feet below grade.

Based upon the soil quality obtained at the HDI site, EMCON concluded that the pipeline was the source of benzene detected in the soil samples.

3.0 SITE EXPLORATION

Soil borings were drilled and soil sampling was conducted to provide data to evaluate the presence of benzene and petroleum hydrocarbons in the subsurface at the Site. The investigation focused on the northeast corner of the Site based upon the proximity to the pipeline easement and analytical data obtained at the HDI site. Soil samples were used for lithologic description and chemical analysis, and one ground-water "grab" sample was collected for analysis.

Two soil borings, BH-1 and BH-2, were drilled to depths of 50 and 30 feet, respectively, at the locations shown in Figure 2. The borings were drilled using truck-mounted hollow-stem auger drilling equipment. Details regarding the soils sampling protocols are described in Appendix A. Lithologic logs for borings BH-1 and BH-2 are included in Appendix B. The Site exploration activities were performed in accordance with guidelines described in the HSP, including the use of Level B respiratory protection (supplied air) and personal protective equipment.

Soil samples were analyzed for volatile organic compounds (VOCs) and petroleum hydrocarbons using EPA Methods 8240 and 8015 (modified), and ground-water samples were analyzed for VOCs using EPA Method 624. The analyses were performed by West Coast Analytical Service (WCAS) of Santa Fe Springs, California. WCAS is certified by the California Department of Health Services (DHS) for the applied test methods.

3.1 Evaluation of Soil Conditions

Soil samples were collected from each borehole for lithologic description and possible chemical analysis at 10-foot intervals, starting at a depth of 10 feet below grade to the terminal depth of each borehole. The borehole cuttings were lithologically described between sampling intervals.

3.1.1 Soil Lithology

The shallow unconsolidated sediments encountered in borings BH-1 and BH-2 consisted of the following:

- o very stiff silty clay (CL) was encountered from ground surface to a depth of about 18 feet;
- o hard sandy clayey silt (ML) was encountered from a depth of about 18 feet to 39 feet below grade in boring BH-1 and to the terminal depth of 30 feet in boring BH-2;
- o dense sand (SP) was encountered from a depth of 39 feet to about 43 feet in boring BH-1; and
- o very dense silty sand (SM) was encountered from a depth of about 43 feet to the terminal depth of 50 feet in boring BH-1.

The soil lithology encountered in borings BH-1 and BH-2 is shown in cross-section in Figure 3.

3.1.2 Soil Emission Screening

Soil emissions were measured in the field using a photoionization detector (PID). The sample screening consisted of sealing a soil sample in a Ziplock plastic bag, breaking the sample apart, and after several minutes, measuring the emissions of the soil sample. The PID measurements are summarized in the lithologic boring logs. LF selected the samples with the highest PID readings for chemical analysis.

3.1.3 Chemical Analysis of Soil Samples

EPA 8240 ANALYSES

Chemical analysis of soil samples by EPA Method 8240 detected the following VOCs at the indicated locations and concentrations:

Boring Number	Depth (feet)	Analyte Detected	Concentration in parts per million (ppm)
BH-1	20	benzene	0.04
		tert-butanol	1.00
		C7 ketone	0.08
		C8 ketone	0.2
		C8-C12 hydrocarbons	2.00
		unidentified compound	0.06
	30	benzene	16.00
		C8-C12 hydrocarbons	2,000.00
	40	benzene	2.60
		C9-C12 hydrocarbons	50.00
BH-2	20	benzene	0.073
		C7 ketone	0.09
		C8 ketone	0.2
		C8-C11 hydrocarbons	0.2
	30	benzene	0.099
		tert-butanol	1.0
		C7 ketone	0.2
		C8 ketone	0.3
		C8-C10 hydrocarbons	0.2
		unidentified compound	0.04

The analytical data for benzene in soils are shown in cross-section in Figure 3.

The laboratory detection limits for the EPA 8240 soil analyses ranged from 0.005 to 10 ppm. Elevated concentrations of VOCs in any discrete sample generally increased the detection limits for each compound in that sample due to necessary dilution of the sample extract during the analytical process. It is therefore possible that additional VOCs may be present in the soil samples at concentrations which do not exceed detection limits for some discrete samples. Specific detection limits for each compound are summarized in the laboratory data sheets in Appendix C.

EPA 8015 ANALYSES

Chemical analysis of soil samples by EPA Method 8015 (modified) detected petroleum hydrocarbons at the indicated locations and concentrations:

Boring Number	Depth (feet)	Analyte Detected	Concentration in parts per million (ppm)
BH-1	20	C5-C10 hydrocarbons	13
	30	C5-C10 hydrocarbons	1,600
		C10-C20 hydrocarbons	120
	40	C5-C10 hydrocarbons	120
BH-2	20	hydrocarbons	ND
	30	hydrocarbons	ND

Notes: ND - Not Detected

The laboratory detection limits for C5-C10 and C10-C20 (light) hydrocarbons are 10 ppm, and for C20-C30 (heavy) hydrocarbons are 100 ppm.

INTERPRETATION OF THE SOIL QUALITY DATA

Chemical analysis of soil samples detected benzene (16 ppm), tert-butanol (1 ppm), C7 ketone (0.9 ppm), C8 ketone (0.2 ppm), and C5-C12 hydrocarbons (2,000 ppm). The concentrations of these compounds were compared to regulatory levels cited below.

The State Action Level, established by the DHS, for benzene in soils is 0.7 ppm, whereby soils which exceed the Action Level normally require remediation. Benzene was detected in soils sampled from boring BH-1 (depths of 30 and 40 feet) at concentrations which exceed the DHS Action Level.

Cleanup levels for petroleum hydrocarbons were calculated for the Site using guidelines and methodologies described in the California Water Resources Control Board's (CWRCB) Leaking Underground Fuel Manual (CWRCB, 1989). Based upon the Site conditions, including depth to ground water, soil types, annual rainfall, and possible man-made conduits to the ground

water, a cleanup level of 100 ppm was estimated. Petroleum hydrocarbons were detected in soils sampled from boring BH-1 (at depths of 30 and 40 feet) at concentrations which exceed typical cleanup levels.

3.2 Evaluation of Ground-Water Conditions

Ground water was encountered at a depth of approximately 49 feet below grade in borehole BH-1. Soil samples were collected at a depth of 50 feet, and the auger was advanced an additional 5 feet prior to water sampling. One ground-water "grab" sample was collected from boring BH-1 using a clean, teflon bailer lowered through the center portion of the hollow-stem auger. The ground-water sample was collected to provide a qualitative evaluation of ground-water conditions near the northeast corner of the Site.

3.2.1 Chemical Analysis of Ground Water

EPA 624 ANALYSIS

Chemical analysis of ground water sampled from boring BH-1 by EPA 624 detected benzene and toluene at concentrations of 1,800 ppm and 4 ppm, respectively.

The solubility level for benzene in water is 1,789 ppm. Benzene was therefore detected at a concentration at its solubility levels, suggesting that benzene may be floating on the water table.

INTERPRETATION OF THE GROUND-WATER QUALITY DATA

Chemical analysis of one ground-water "grab" sample detected benzene (1,800 ppm) and toluene (4 ppm). Concentrations of benzene and toluene were compared to maximum contaminant levels (MCLs) for drinking water recommended by the U.S. Environmental Protection Agency (USEPA). The MCLs for benzene and toluene are 0.005 ppm and 2 ppm, respectively (USEPA, 1990). Benzene and toluene were detected in the ground-water sample at concentrations which exceed the MCLs.

4.0 CONCLUSIONS

The objective of this preliminary subsurface investigation was to evaluate shallow soil and ground-water conditions near a pipeline easement located in the northeast corner of the Site.

Chemical analysis of soil samples detected benzene, petroleum hydrocarbons, tert-butanol, ketones, and unidentified compounds.

Results indicate that soils in the vicinity of boring BH-1 have been affected by benzene. Benzene was detected in soils sampled from boring BH-1 (depths of 30 and 40 feet) at concentrations which exceed regulatory action levels. Relatively low concentrations of benzene were detected in soils sampled from borings BH-1 (depth of 20) and BH-2 (depths of 20 and 30 feet).

Petroleum hydrocarbons were detected at concentrations which exceed typical cleanup levels in boring BH-1 (depths of 30 and 40 feet). Relatively low concentrations of hydrocarbons were detected in soils sampled from borings BH-1 (depth of 20 feet) and BH-2 (depths of 20 and 30 feet).

Regulatory levels have not been established for tert-butanol and ketones in soils.

These results indicate that soils in the vicinity of boring BH-1 have been affected by benzene and petroleum hydrocarbons. Benzene concentrations appear to diminish south of boring BH-1, based on results from boring BH-2. Based on the limited Scope of Work for the preliminary investigation, insufficient data are available to draw further conclusions on the distribution of benzene and petroleum hydrocarbons in the subsurface.

Chemical analysis of ground water sampled from borehole BH-1 detected benzene and toluene at concentrations which exceed regulatory levels. Benzene was detected at a concentration at its solubility level, suggesting the possibility that benzene may be floating on the water table.

Based upon the elevated concentrations of benzene detected in soils and ground water sampled at the Site, it is believed soil and ground-water remediation will be required by regulators.

5.0 RECOMMENDATIONS

Additional investigation is needed to further evaluate the distribution of benzene- and hydrocarbon-affected soil and ground water. Levine•Fricke recommends that additional investigation be performed to include the following tasks:

- correlate available soil and ground-water quality data obtained from the immediate Site vicinity with the results of this investigation;
- drill exploratory borings and sample soil;
- monitor well installation, development, and sampling;

Once the magnitude of the problem has been further evaluated, conceptual remedial options and strategies can be developed and discussed. A proposal for the additional investigation will be provided under separate cover.

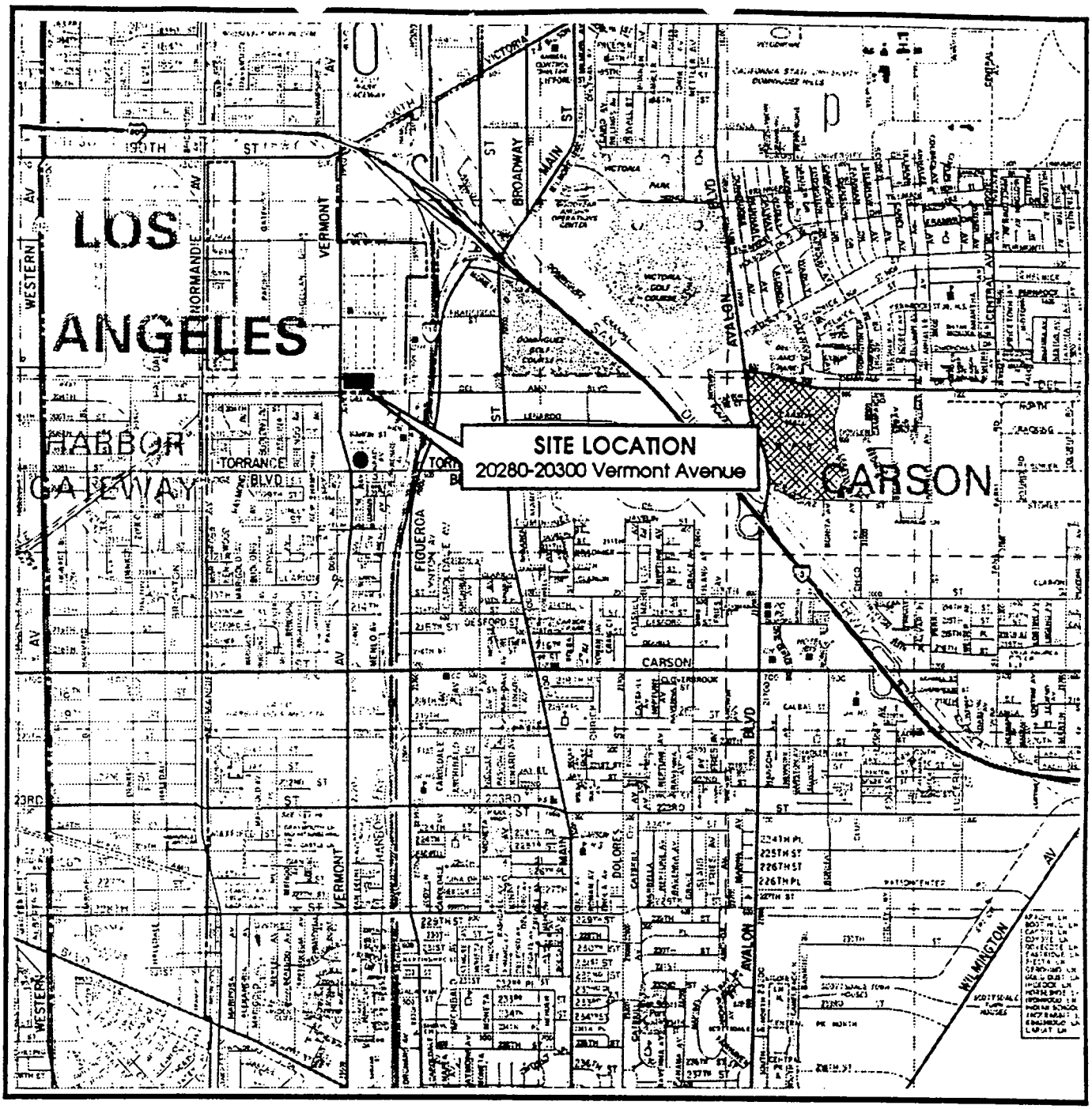
6.0 REFERENCES

California Water Resources Control Board, Leaking Underground Fuel Tank (LUFT) Field Manual (March 1989).

EMCON Associates, Assessment of Potential Soil Contamination 20221 Hamilton Avenue, Los Angeles, California (March 1989).

ERT, Soil Vapor Survey and Soil Boring Investigations at 20221 Hamilton, Torrance, California (August 1988).

U.S. Environmental Protection Agency, Drinking Water Regulations and Health Advisories (April 1990).



MAP SOURCE: Thomas Bros. Guide, Los Angeles County, California, p. 68,69, 1990.

SCALE

0 1/4 1/2 1 MILE

Figure 1 : SITE VICINITY

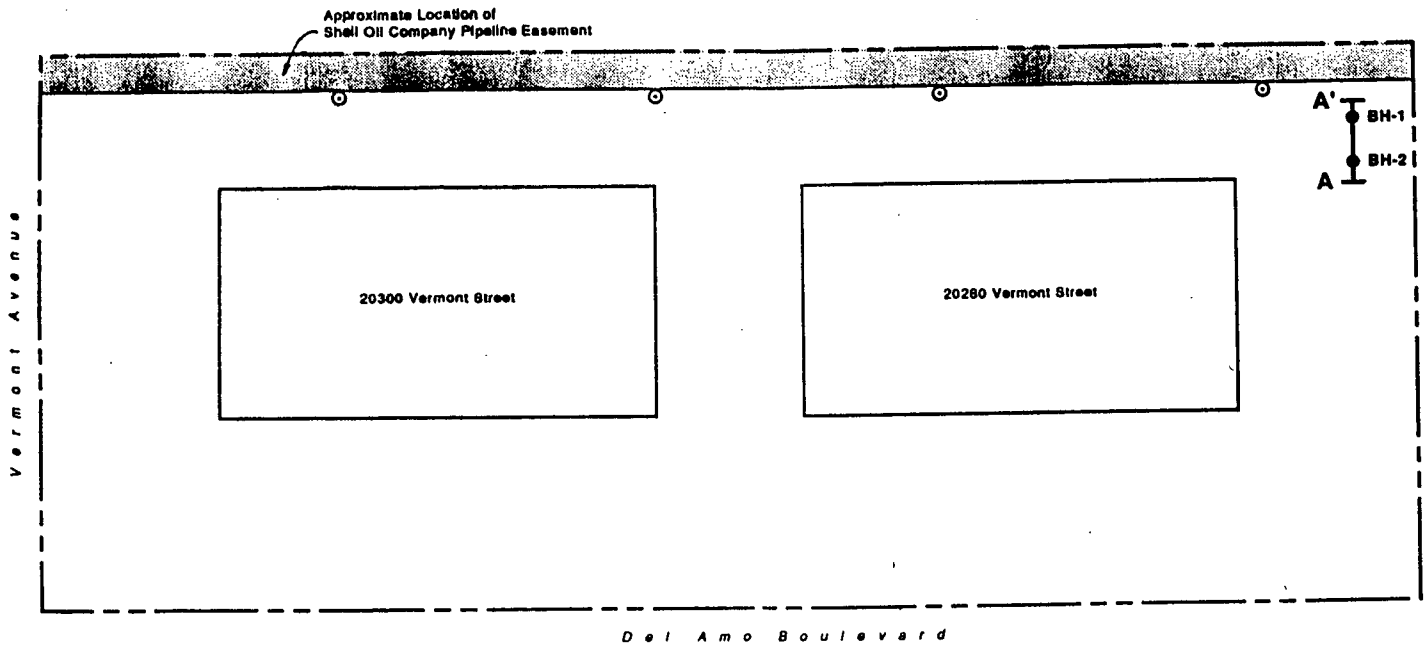
DRAFT

Project No. 2266

LEVINE • FRICKE
CONSULTING ENGINEERS AND HYDROGEOLOGISTS

122090SGT/scj

2266-02



EXPLANATION

- ⊙ Exploratory Borings (by others)
- BH-2 ● Soil Boring drilled by Levine-Fricke
- A—A' Cross Section Location
- Approximate Property Boundary

SCALE
0 25 50 100 FEET
1 INCH = 50 FEET

N

DRAFT

Figure 2 :

SITE PLAN FOR HARBOR TECHNOLOGY CENTER
20280-20300 VERMONT STREET,
TORRANCE, CALIFORNIA

Project No. 2266

LEVINE • FRICKE
CONSULTING ENGINEERS AND HYDROGEOLOGISTS

(220905GT/sc)

2266-03

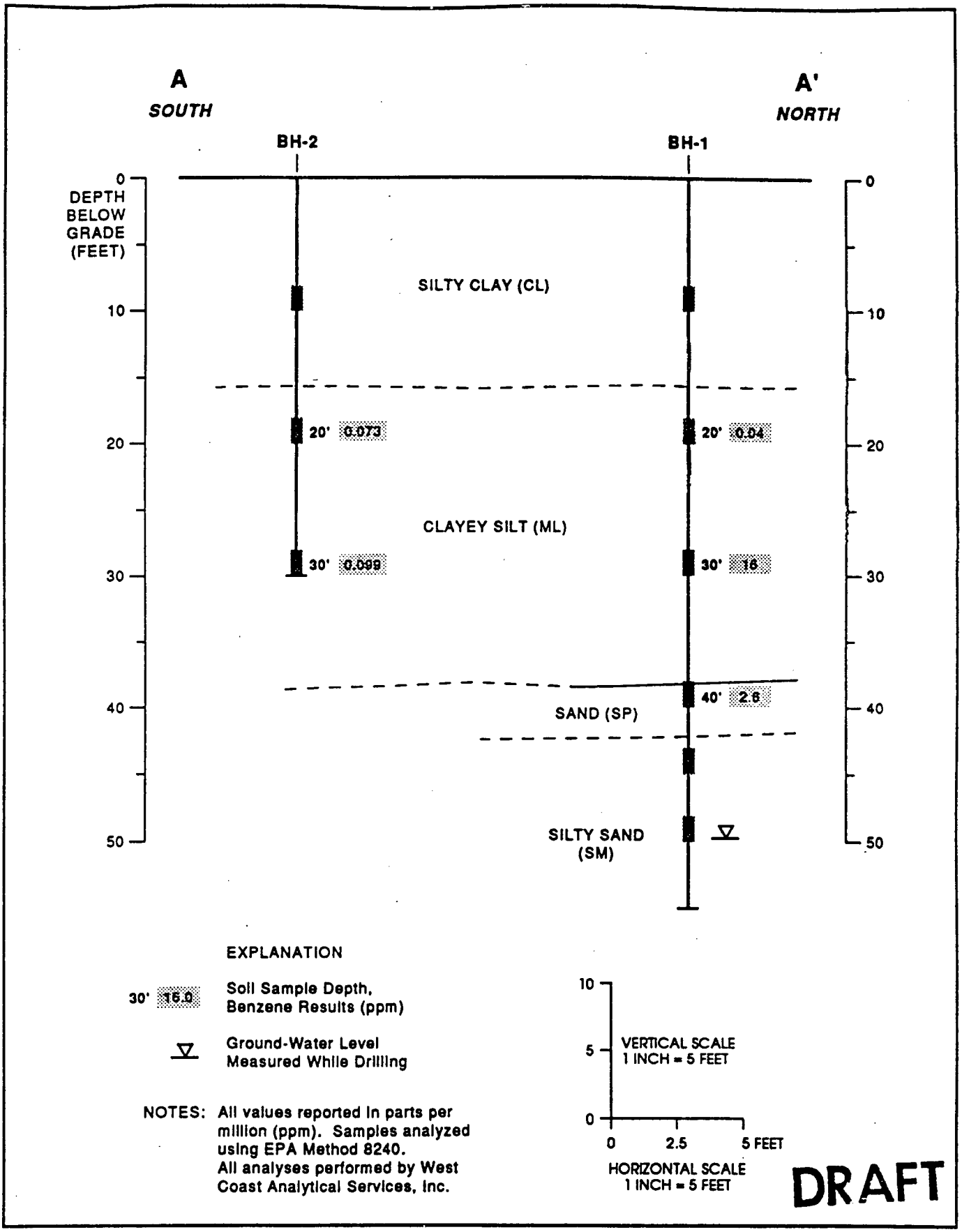


Figure 3 : CROSS-SECTION SHOWING SOIL LITHOLOGY AND ANALYTICAL DATA FOR BENZENE (PPM)

A P P E N D I X A

Description of Field Activities

12/21/90

L·F 2266

APPENDIX A

Description of Field Activities

1.0 EXPLORATORY BORINGS AND SOIL AND GROUND-WATER SAMPLING PROCEDURES

1.1 Soil Boring and Sampling Procedures

Soil borings were drilled and soil sampling was conducted to provide data to evaluate the extent of volatile organic compounds (VOCs) in the subsurface at the Site. Soil samples were used for one of several purposes, including lithological description and chemical analysis. The methodologies used for each sampling purpose are discussed in the following section.

Lithological Data

Soil samples for lithologic description were collected using a split-barrel drive sampler lined with clean, brass tubes. Soil samples were collected at 10-foot (minimum) intervals. The lithology of these samples was described in the field by a trained Levine·Fricke geologist. Lithologic logs were prepared using the Unified Soil Classification System and standard geologic nomenclature.

Soil Sampling

Soils from soils boring BH-1 and BH-2 were collected for chemical analysis using a modified California sampler lined with three brass tubes. The ends of the retained tubes were lined with aluminum foil or Teflon, capped with airtight plastic lids, and taped around the caps to prevent possible moisture and VOC loss. Soils immediately above and below the retained sample tube were used for lithologic description and to obtain field measurements of VOC concentrations in soil headspace. (See discussion of soil sample screening.) After being sealed and labeled, soil samples selected for analysis were immediately placed in a chilled cooler for delivery to the analytical laboratory.

Soil Sample Screening

Emissions from soil samples were measured in the field using a photoionization detector (PID). The sample screening

consisted of sealing a soil sample in a Ziplock plastic bag, breaking the sample apart, and after several minutes, measuring the emissions from the soil sample. Soils sampled from the borings were generally screened at a minimum of 5-foot intervals. The PID measurements are summarized on each soil boring log.

1.2 Borings

Soil borings BH-1 and BH-2 were drilled using truck-mounted hollow-stem auger drilling equipment. Sampling for lithologic description was conducted following the methodology described in Section 1.1. Drilling and lithologic logging of the boring were conducted under the supervision of a Levine·Fricke California Registered Geologist (RG).

1.2.1 Lithologic Logging

Sediments encountered during drilling (including soils) were examined and described by the geologist on-Site, who maintained a record of these descriptions. Sediment descriptions were in accordance with the Unified Soil Classification System. Sediments were sampled for lithologic description at minimum intervals of approximately 10 feet. The borehole cuttings were used for lithologic description between sampling intervals. The boring logs (Appendix B) contain the following information:

- borehole number and location;
- sample depth;
- sediment color;
- sediment grain size;
- relative percentage of grain sizes;
- descriptive comments;
- estimated moisture content; and
- depth where ground water was encountered during drilling (for boring BH-1 only).

A Levine·Fricke Registered Geologist reviewed the lithologic logs.

1.2.2 Borehole Cuttings and Backfilling

Borehole soil cuttings generated from the Site exploration were placed in 55-gallon drums and temporarily stored on-Site. Temporary fencing was constructed around the soil drums. Disposal of the soil cuttings is the responsibility of Graham & James.

Following completion of soil and ground-water sampling activities, each borehole was backfilled with bentonite chips. The bentonite was placed in the borehole at 5-foot intervals, and each interval was subsequently charged with tap water.

1.3 Ground-Water Sampling Procedures

This section describes routine procedures followed by persons sampling ground water at the Site. The techniques are designed to ensure quality data acquisition and collection of representative samples, and to minimize sample contamination. Guidelines for well sampling are as follows:

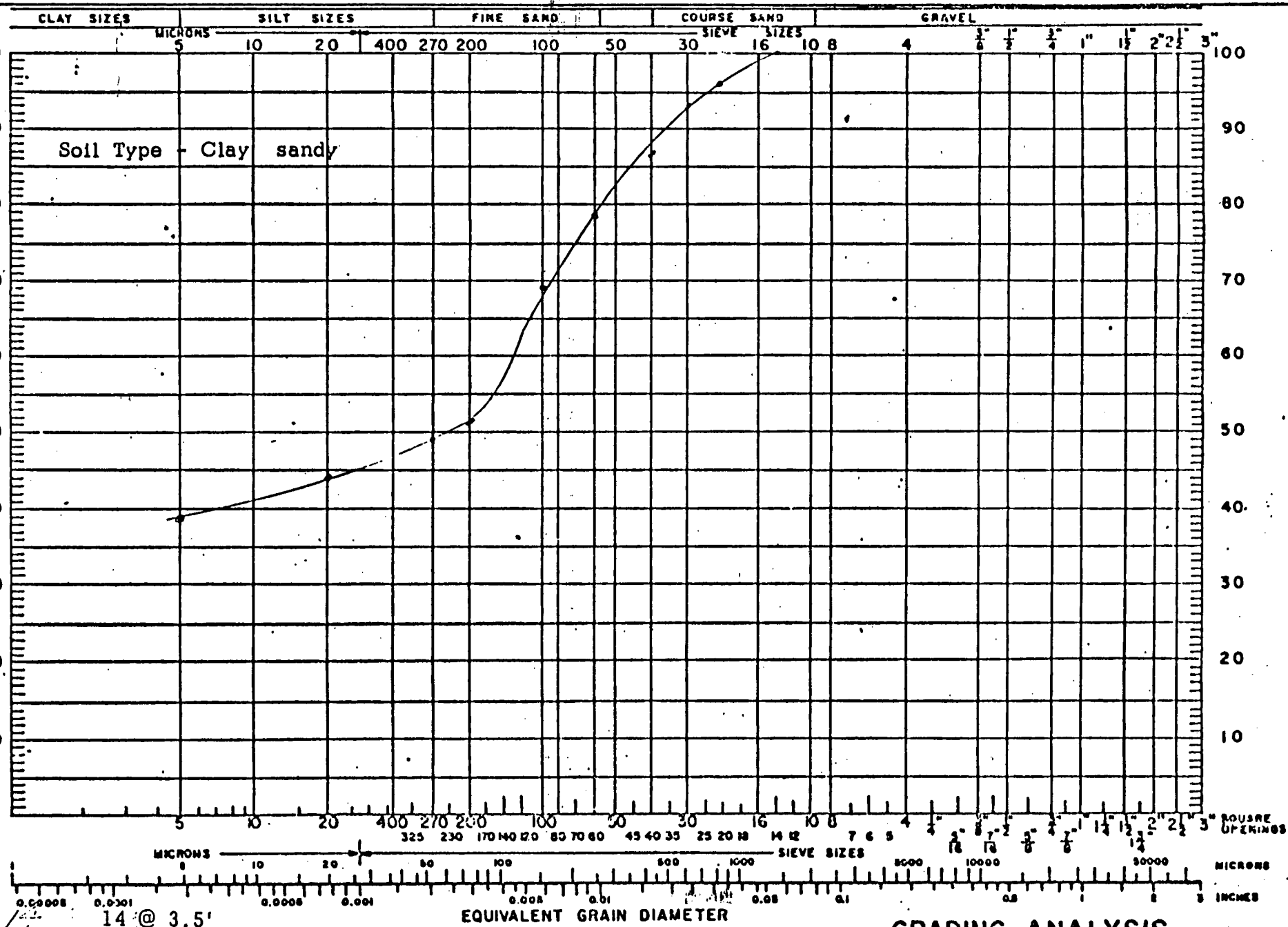
Method of Collection

One ground-water "grab" sample was collected from boring BH-1 using a clean, teflon bailer lowered through the center portion of the hollow-stem auger. The ground-water sample was collected to provide a qualitative evaluation of ground-water conditions near the northwest corner of the Site.

Sample containers were filled to overflowing directly from the bailer and then capped immediately. Water was slowly poured from the bailer to minimize aeration.

Samples were placed in a chilled cooler and transported to the laboratory via hand delivery.

PLATE P



NO. 14 @ 3.5'

DATE 9/11/72 BY C.W.

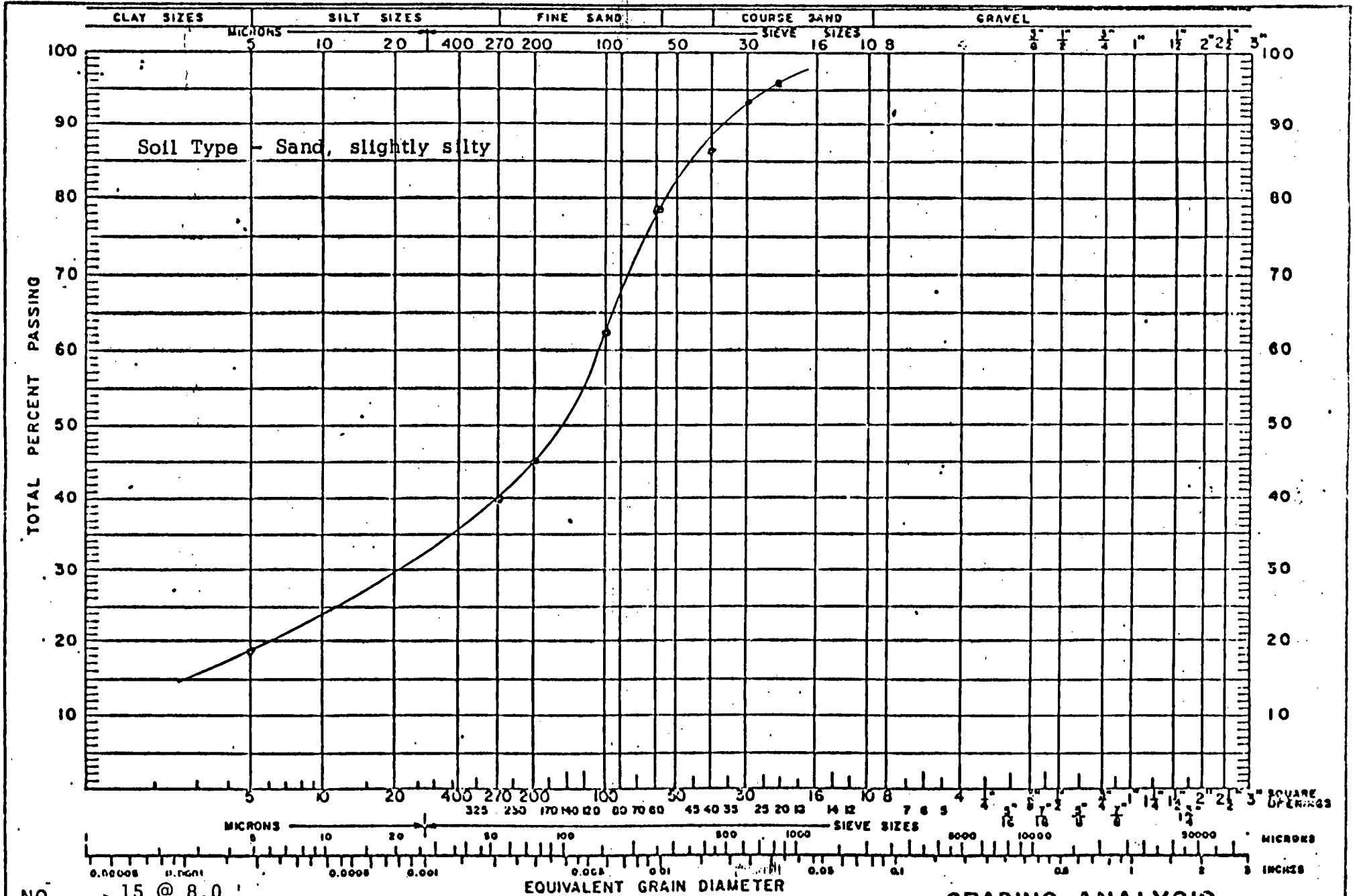
LOCATIO Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4999

FIGURE NO.

PLATE Q



NO. ~15 @ 8.0'

DATE 9/11/72 BY C.W.

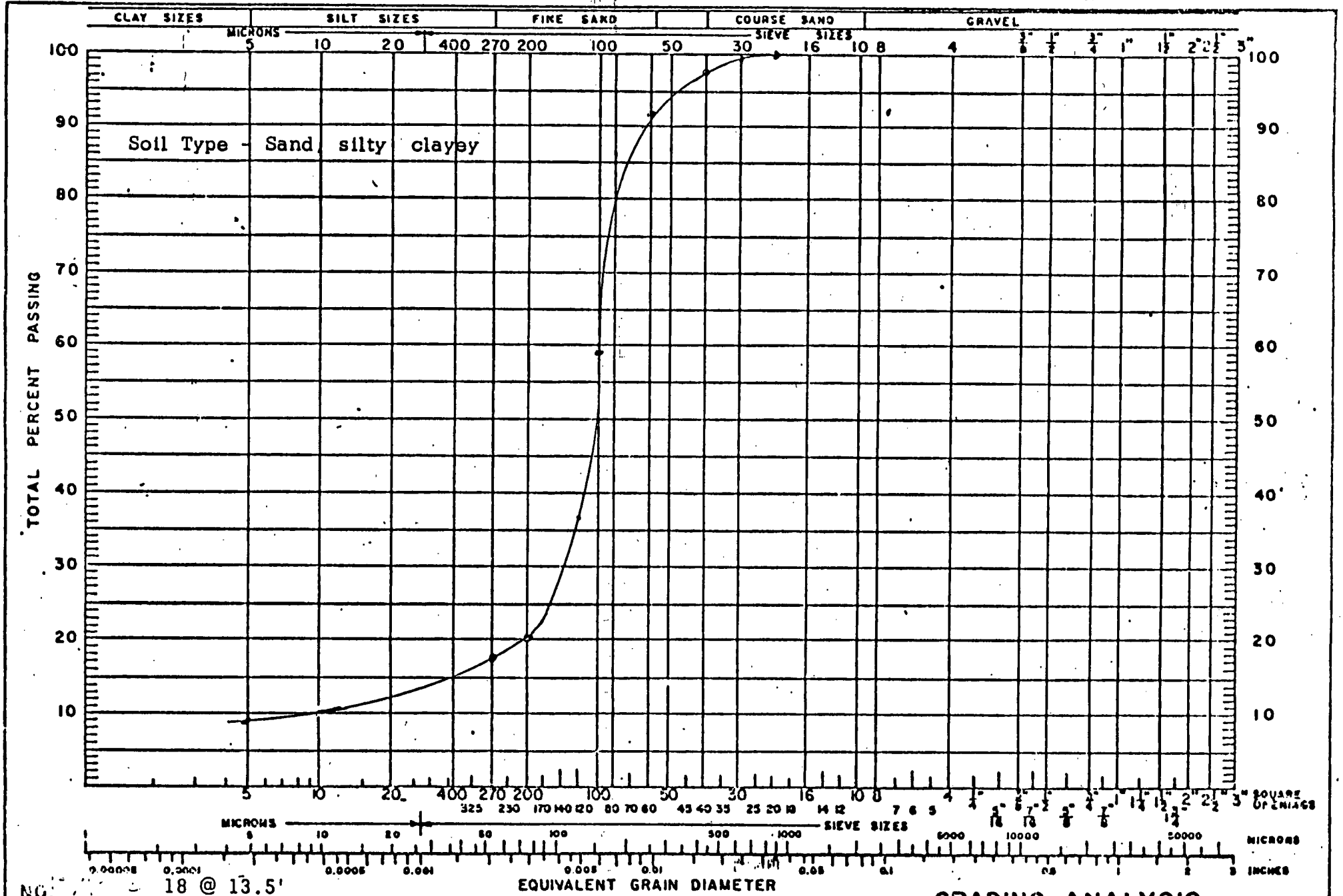
LOCATIC Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 49

FIGURE NO.

PLATE R



NO. 18 @ 13.5'

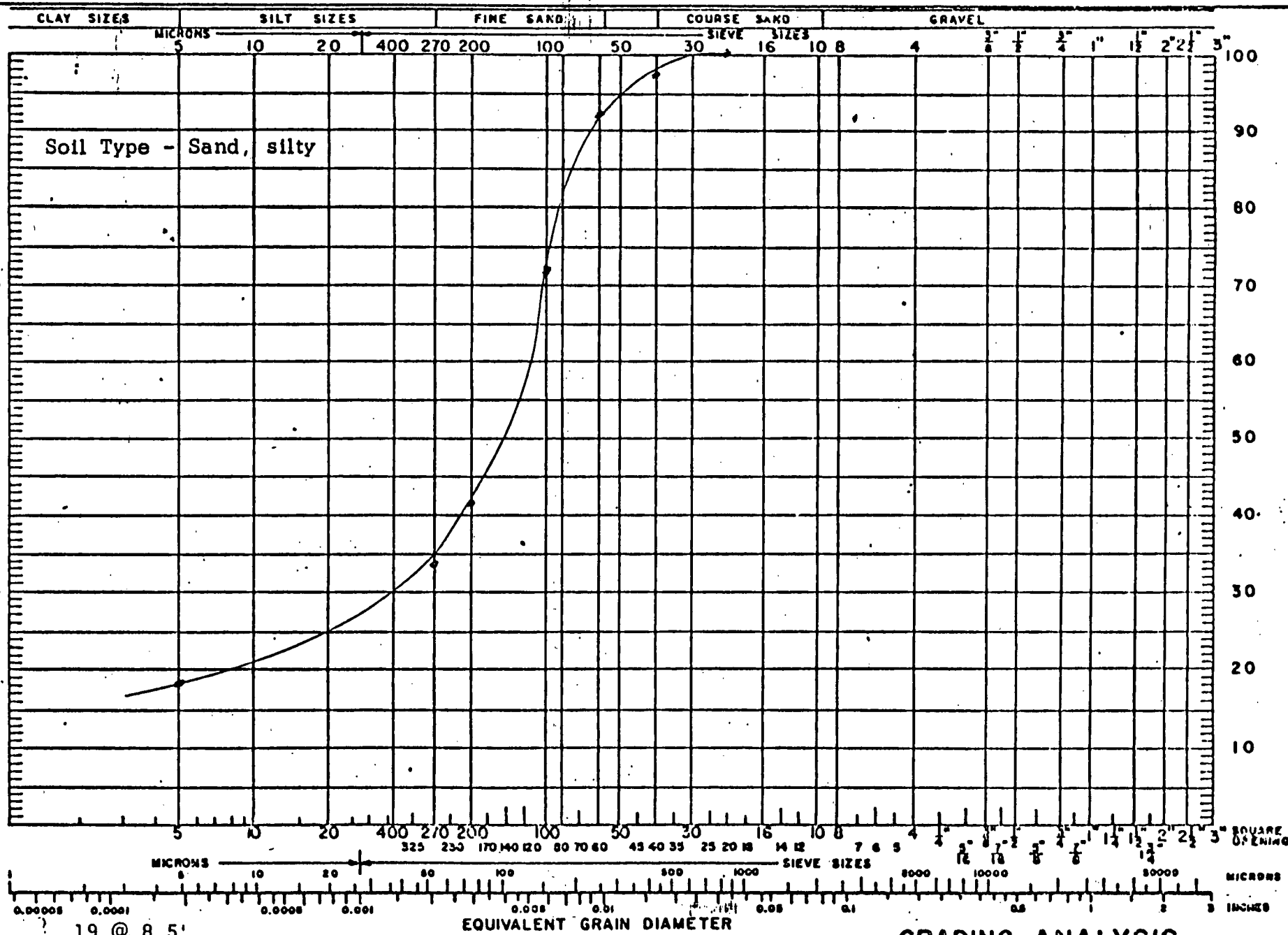
DATE 9/11/72 BY C.W.

LOCATION Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 499

PLATE S



NO. 19 @ 8.5'

DATE 9/11/72 BY C.W.

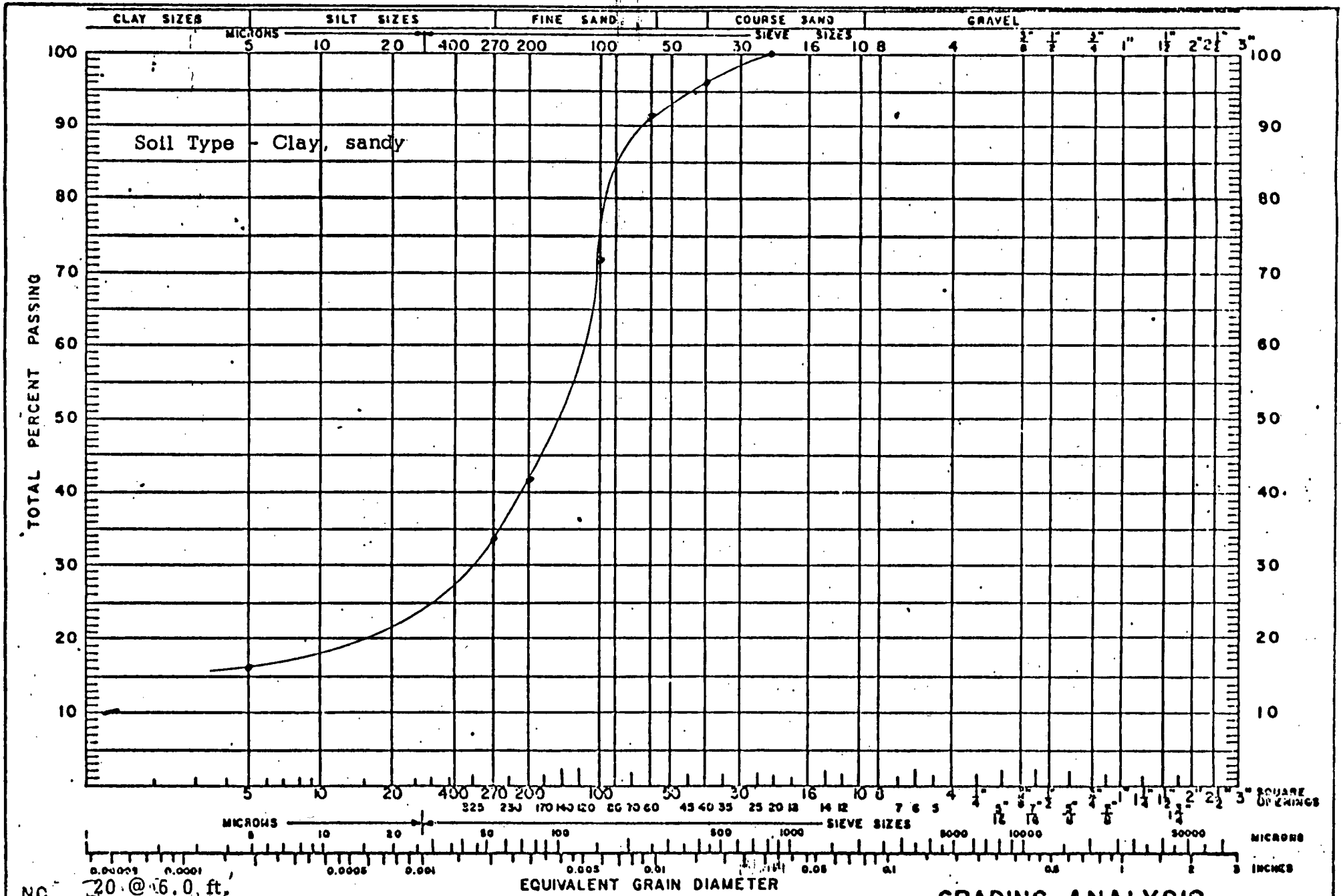
LOCATIO' Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 49

FIGURE NO.

PLATE T



NO. 20 @ 6.0 ft.

DATE 9/11/72 BY C.W.

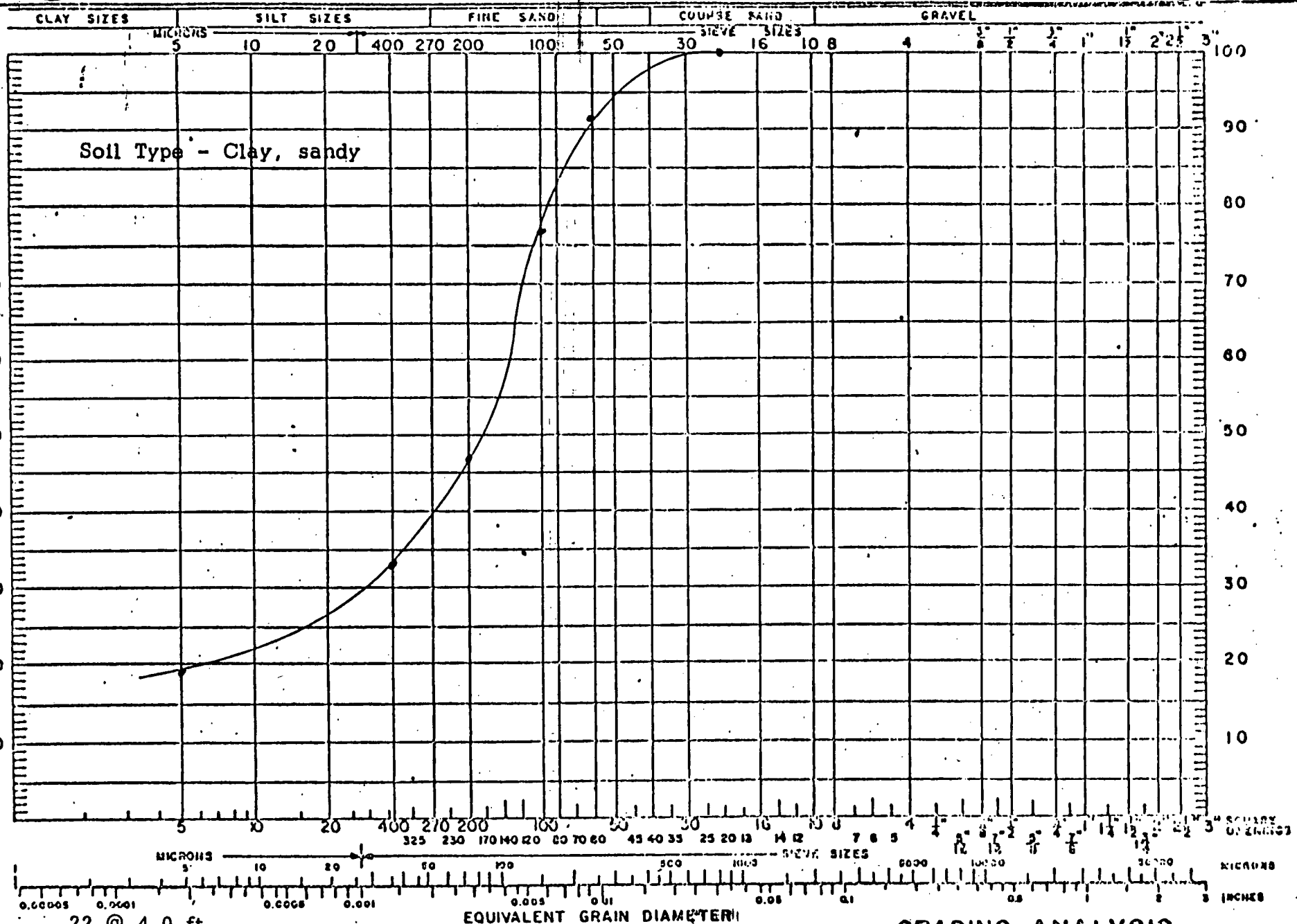
LOCATION Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4999

FIGURE NO.

PLATE U



NO: 22 @ 4.0 ft.

DATE 9/11/72 BY C.W.

LOCATION Shell Chemical Facility

GRADING ANALYSIS

PROJECT NO. 4999

FIGURE NO.

Work Order [illegible]

TABLE V

ATTERBERG LIMITS

Sample No.	Soil Classification	Liquid Limit	Plastic Limit	Plastic Index
[illegible] 4.5'	Clay, sandy	32	22	10
[illegible] 3.5'	Clay, sandy	36	16	20
[illegible] 3.5'	Clay, sandy	37	17	20
[illegible] 3.5'	Clay, sandy	43	20	23
[illegible] 10.5'	Sand, silty	21	-*	-*
[illegible] 1.5'	Clay, sandy	30	17	13

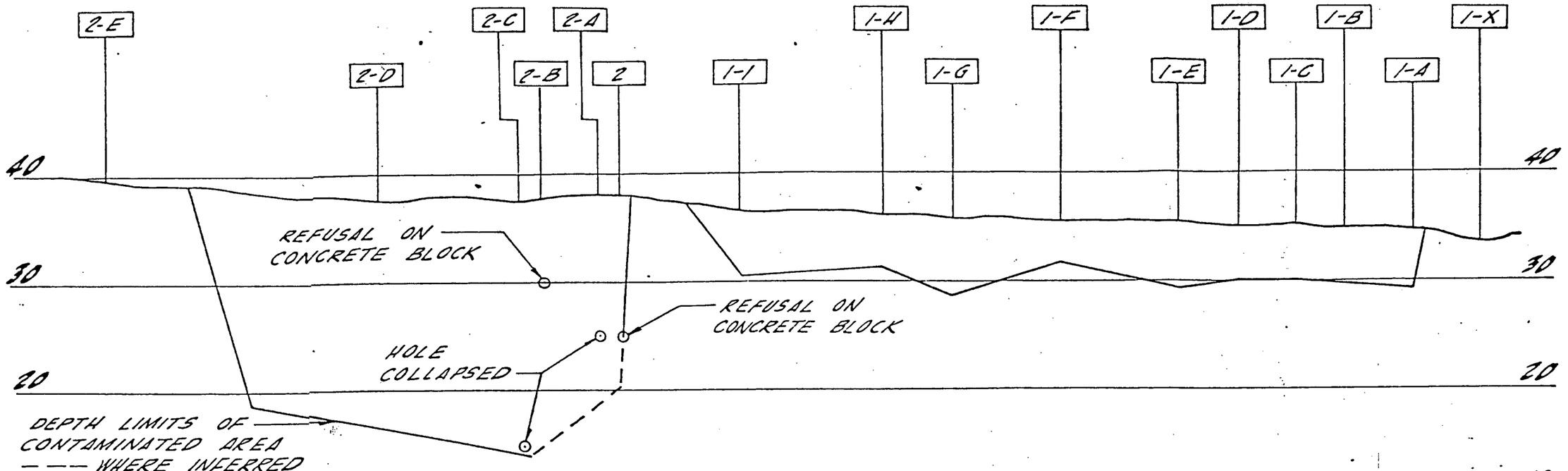
* Not possible, sandy material

UNCONFINED COMPRESSION SUMMARY SHEET

SAMPLE NUMBER	SOIL CLASSIFICATION	LOAD lbs	PSI	TON/ft²	MOISTURE CONTENT	UNIT WEIGHT
6 @3.5	SANDY CLAY	137	27.1	4.02	15.9%	112.5
15@8.5	" "	186	37.8	5.45	12.4	116.5
16@4.5	" " (RED BROWN)	350	71.2	10.2	16.3	117.8
10@8.5	SILTY CLAYEY SAND	175	35.6	5.12	18.5	102.5
7@3.5	SANDY CLAY	300	61.0	8.8	10.2	131.0
20@6.0	" "	105	21.4	3.08	15.9	111.0
22@4.0	" "	210	42.7	6.15	14.1	116.0
11@8.5	SILTY SAND	300	61.0	8.8	11.9	122.5

SHELL CHEMICAL FACILITY

PLATE W



SCALE

VERTICAL 1 Inch = 10 Feet
HORIZONTAL 1 Inch = 100 Feet

NOTE:
REFER TO PLATE NO: 1 FOR LOCATION

Sept. 26, 1979
AS NOTED
4999

PREPARED FOR

CABOT, CABOT & FORBES

WESTERN LABORATORIES
17926 S. NORMANDIE AVENUE
GARDENA, CALIFORNIA